AD-A219 895

DTIC FILE COPY

UNITED STATES AIR FORCE

SUMMER FACULTY RESEARCH PROGRAM

1989

PROGRAM MANAGEMENT REPORT

UNIVERSAL ENERGY SYSTEMS, INC.
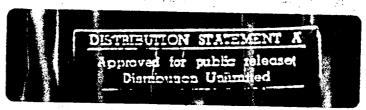
PROGRAM DIRECTOR, U. E. S.

RODNEY C. DARRAH

PROGRAM ADMINISTRATOR, U. E. S.

SUSAN K. ESPY

PROGRAM MANAGER, A. F. O. S. R.

LT. COL CLAUDE CAVENDER

SUBMITTED TO

AIR FORCE OFFICE OF SCIENTIFIC RESEARCH

BOLLING AIR FORCE BASE

WASHINGTON, DC

DECEMBER 1989

90 03 23 181

REPORT DOCUMENTATION PAGE

1. REPORT SECURITY CLASSIFICATION	1b. RESTRICTIVE MARKINGS
UNCLASSIFIED	

2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT
	APPROVED FOR PUBLIC RELEASE;
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	Distribution Unlimited

4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S)
	AFOSR-TR-90-0365

6a. NAME OF PERFORMING ORGANIZATION	6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION
Universal Energy Systems, INc		AFOSR/XOT

6c. ADDRESS (City, State and ZIP Code)	7b. ADDRESS (City, State and ZIP Code)
4401 Dayton-Xenia Road Dayton, OH 45432	Building 410 Bolling AFB, DC 20332

8a. NAME OF FUNDING/SPONSORING ORGANIZATION	8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
AFOSR	XOT	F49620-85-C-0013

8c. ADDRESS (City, State and ZIP Code)	10. SOURCE OF FUNDING NOS.			
	PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	WORK UNIT NO.
Building 410 Bolling AFB, DC 20332	61102F	3396	D5	

11. TITLE (Include Security Classification)
USAF Summer Faculty Research Program - Management Report -

12. PERSONAL AUTHOR(S)
Rodney C. Darrah, Susan K. Espy

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Yr., Mo., Day)	15. PAGE COUNT
Annual	FROM _____ TO _____	Dec 89	

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB. GR.	

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

See Attached

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
UNCLASSIFIED/UNLIMITED XX SAME AS RPT. ☐ DTIC USERS ☐	UNCLASSIFIED

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE NUMBER (Include Area Code)	22c. OFFICE SYMBOL
Lt Col Claude Cavender	202-767-4970	XOT

PREFACE

The United States Air Force Summer Faculty Research Program (USAF-SFRP) is designed to introduce university, college, and technical institute faculty members to Air Force research. This is accomplished by the faculty members being selected on a nationally advertised competitive basis for a ten-week assignment during the summer intersession period to perform research at Air Force laboratories/centers. Each assignment is in a subject area and at an Air Force facility mutually agreed upon by the faculty members and the Air Force. In addition to compensation, travel and cost of living allowances are also paid. The USAF-SFRP is sponsored by the Air Force Office of Scientific Research, Air Force Systems Command, United States Air Force, and is conducted by Universal Energy Systems, Inc.

The specific objectives of the 1989 USAF-SFRP are:

(1)   To provide a productive means for U.S. faculty members to participate in research at Air Force Laboratories/Centers;

(2)   To stimulate continuing professional association among the faculty and their professional peers in the Air Force;

(3)   To further the research objectives of the United States Air Force;

(4)   To enhance the research productivity and capabilities of the faculty especially as these relate to Air Force technical interests.

During the summer of 1989, 168-faculty members participated. These researchers were assigned to 23 USAF laboratories/centers across the country. This four volume document is a compilation of the final reports written by the assigned faculty members about their summer research efforts.

UNITED STATES AIR FORCE

SUMMER FACULTY RESEARCH PROGRAM

1989

PROGRAM MANAGEMENT REPORT

UNIVERSAL ENERGY SYSTEMS, INC.

Program Director, UES
Rodney C. Darrah

Program Manager, AFOSR
Lt. Col. Claude Cavender

Program Administrator, UES
Susan K. Espy

Submitted to

Air Force Office of Scientific Research

Bolling Air Force Base

Washington, DC

December 1989

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF TABLES

I.   INTRODUCTION

Universal Energy Systems, Inc. (UES) was awarded the United States Air Force Summer Faculty Research Program on August 15, 1984. The contract is funded under the Air Force Systems Command by the Air Force Office of Scientific Research.

The program has been in existence since 1978 and has been conducted by several different contractors. The success of the program is evident from its history of expansion since 1978.

The Summer Faculty Research Program (SFRP) provides opportunities for research in the physical sciences, engineering, and life sciences. The program has been effective in providing basic research opportunities to the faculty of universities, colleges, and technical institutions throughout the United States.

The program is available to faculty members in all academic grades: instructor, assistant professor, professor, department chairman, and research facility directors. It has proven especially beneficial to young faculty members who are starting their academic research programs and to senior faculty members who have spent time in university administration and are desirous of returning to scholarly research programs.

Beginning with the 1982 program, research opportunities were provided for graduate students. The 1982 pilot student program was highly successful and has expanded from its initial involvement with 17 graduate students to its current level of 102 graduate students in the 1989 program. Initially the graduate students were selected along with their professors to participate in the program. Starting with the 1985 program, the graduate students were selected on their own merits. The students were assigned to be supervised by either a professor on the SFRP or an engineer/scientist at the participating Air Force Laboratory. The following table shows the growth of this program.

Year	Number of graduate students
1982	17
1983	53
1984	84
1985	92
1986	100
1987	101
1988	107
1989	102

Table 1   Growth of GSRP

The 1989 GSRP report is published as four separate documents under the 1989 Summer Faculty Research Program and are entitled, Graduate Student Summer Support Program Management Report and Technical Reports, Volume I, II and III, October 1989.

Follow-on research opportunities have been developed for a large percentage of the participants in the SFRP. In 1979-1983 period this was accomplished through an AFOSR Minigrant Program.

On 1 September 1983, AFOSR replaced the Minigrant Program with a new Research Initiation Program (RIP). The RIP provides follow-on research awards to home

1

institutions of SFRP participants. Awards were made to approximately 50 researchers in 1983. The awards were for a maximum of $12,000 and a duration of one year or less. Substantial cost sharing by the schools contributes significantly to the value of the RIP.

For the 1985 program, the amount of the RIP was increased to a maximum of $20,000. The growth of the RIP is shown in Table 2.

Year	Number of SFRP Fellows	Number of RIP Applicants	Number of RIP Awards
1983	101	No Data	50
1984	152	No Data	80
1985	154	120	82
1986	158	141	97
1987	159	124	83
1988	153	126	92
1989	168	N/A	(Approx. 75)

Table 2   Growth of the RIP

Funding and cost sharing for the RIP is shown in Table 3.

Year	Number of RIP's	AFOSR Funding	Cost Sharing
1985	82	$1,551,091.00	$782,812.00
1986	97	$1,932,164.00	$754,857.00
1987	83	$1,646,379.00	$721,398.00
1988	92	$1,826,152.00	$967,713.00

Table 3   RIP Funding and Cost Sharing

Under the SFRP a High School Apprenticeship Program was conducted. This program is described in Section VI of this report.

II.   RECRUITING AND SELECTION

The program is conducted on a nationally advertised and competitive selection basis. Advertising for the 1989 program was conducted via direct mail to all accredited schools. The mailing was sent to the department chairman at the schools. The departments included biology, genetics, ecology, entomology, chemistry, computer science, graphics, mathematics, physics, aeronautical engineering, ceramic engineering, chemical engineering, materials science, mechanical engineering, electrical engineering, metallurgy, nuclear science, and psychology. The brochures were also mailed to all of the participants in the 1985, 1986, 1987, and 1988 programs. Brochures were mailed to the Presidents of Historically Black Colleges. The brochures were sent to all participating USAF laboratories/centers; distribution was made through AFROTC units on university

campuses; information was supplied to all who made requests. Overall, more than 17,000 brochures were distributed throughout the country.

Application deadline was February 1, 1989. There were over four (4) applications received for each position available on the 1989 Summer Faculty Research Program. The selection panels met in February. The announcements of selections were mailed on March 1, 1989. In total, 201 offers of position were made for the Summer Faculty Research Program, with 168 professors accepting appointments. Table 4 shows the growth in the number of faculty and graduate students participating in the program.

Year	Number of SFRP Participants	Number of GSRP Participants
1979	70	0
1980	87	0
1981	87	0
1982	91	17
1983	101	53
1984	152	84
1985	154	92
1986	158	100
1987	159	101
1988	153	107
1989	168	102

Table 4 SFRP and GSRP Participation

III. PRE-SUMMER VISIT (Optional)

Each Summer Fellow was directed to contact the designated representative at the laboratory/center of assignment to discuss a pre-summer visit. The purpose of the pre-summer visit is basically threefold: 1) to meet with laboratory personnel, especially the Effort Focal Point with whom the Summer Fellow would be working most closely, and to become personally acquainted with the laboratory facilities; 2) to finalize and formalize objectives for the Summer Fellow's summer research period and report these to UES; 3) to make arrangements for lodging for the research period. The focus of this visit was on making sufficient preparations so that the ten week summer research effort would be effective.

IV. SITE VISITS

Visits listed below include those by UES and AFOSR personnel. The faculty, USAF research colleagues, and student participants are generally satisfied with the program. Criticisms were: a) too much paper work to administer program, b) housing difficult to find, c) delays experienced in receiving payment d) 10 weeks too short for research period.

June 20, 1989   Astronautics Laboratory
                       Edwards Air Force Base, California

3

June 21, 1989	HRL: Operations Training Division Williams Air Force Base, Arizona
June 22, 1989	Weapons Laboratory Kirtland Air Force Base, New Mexico
June 23, 1989	Frank J. Seiler Research Laboratory United States Air Force Academy, Colorado
June 27, 1989	Rome Air Development Center Griffiss Air Force Base, New York
June 28, 1989	Electronic Systems Division Geophysics Laboratory Hanscom Air Force Base, Massachusetts
June 29, 1989	Wright-Patterson Air Force Base Dayton, Ohio
July 11, 1989	Arnold Engineering Development Center Arnold Air Force Base, Tennessee
July 12, 1989	Engineering Services Center Tyndall Air Force Base, Florida
July 13, 1989	Armament Division Eglin Air Force Base, Florida
July 14, 1989	School of Aerospace Medicine HRL: Training Systems Division HRL: Manpower and Personnel Division Occupational and Environment Health Laboratory Brooks Air Force Base, Texas

Because of the proximity of UES to Wright-Patterson Air Force Base, several site visits were made to the following laboratories:

Aerospace Medical Research Laboratory
Aero Propulsion Laboratory
Avionics Laboratory
Flight Dynamics Laboratory
Human Resources Laboratory
Materials Laboratory
Wright-Patterson Air Force Base, Ohio

We find that the objectives of the SFRP are being well served. SFRP Research Fellows indicate that they are performing independent research, and are not being used as "summer help". There are some misconceptions by research colleagues and summer fellows concerning the purpose of the program; one misconception is that the program is suitable for repeated research efforts by an individual. However, in this program we have found no abuse of the non-personal services requirements. As expected, enthusiasm is high for the possibilities of follow-on funding by AFOSR at the home university. Research fellows often conduct lectures and seminars at the Air Force locations.

As a record of the documentation supplied to the appointees, the UES Information and Appointment Packets are provided in Appendix I of this report.

V.   HISTORICALLY BLACK COLLEGES/UNIVERSITIES (HBCU's) WORKSHOP

In support of the Summer Faculty Research Program, and as part of the UES EEO/Affirmative Action Program, UES sponsored an information booth at the NAFEO (National Association for Equal Opportunity in Higher Education) Conference. The conference was held on April 19 through April 23, 1989. UES provided information on the UES-AFOSR summer programs at this conference.

Data prior to 1985 is not available for this report. Table 5 lists the participation of the HBCU's in these programs.

Year	Number of HBCU SFRP Applicants	Number of HBCU GSRP Applicants	Number of HBCU RIP Applicants
1985	76	15	10
1986	70	20	16
1987	82	32	23
1988	53	23	8
1989	39	13	N/A

Year	Number of HBCU on SFRP	Number of HBCU on GSRP	Number of HBCU on RIP
1985	23	11	7
1986	18	10	10
1987	18	10	7
1988	17	14	4
1989	15	4	N/A

Table 5   HBCU Participation

VI.   HIGH SCHOOL APPRENTICESHIP PROGRAM (HSAP)

As part of the Special Studies section of the Summer Faculty Research Program, UES initiated an Air Force High School Apprenticeship Program in 1986. The purpose of the program was to place highly qualified and highly motivated high school students in the Air Force Laboratories for orientation and training in science and engineering. UES provided the recruiting, selection, and management to start up the Air Force HSAP. Much of the program development was based on the successful Army High School Program and material prepared under the contract to the Department of the Army by the National Institute for Work and Learning. To accomplish this effort, UES followed the schedule presented in Table 1. There were 42 High School students participating in the 1986 program and 73 High School students participating in the 1987 program, 101 in the 1988 program, and 103 students in the 1989 program.

TABLE 1
AIR FORCE HIGH SCHOOL
APPRENTICESHIP PROGRAM

Calendar of Activities

December	o	Identify schools and laboratories for participation
	o	Prepare informational material for schools and installations application forms for students and mentors, and covering letters.
	o	Disseminate information
	o	Recruit apprentices, mentors
January	o	Send student applications to teachers
February	o	Applications with teacher recommendations
	o	Receive mentors' project descriptions and student requirements
	o	Make preliminary selection of students for referral to mentor
March	o	Make preliminary matching of students with mentors; send letters with several student applications to each mentor
	o	Mentors interview students, inform UES of choice
April	o	Send letters of placement to students, with acceptance forms to be signed by them and parents and returned to UES
	o	Place 2nd year apprentices
	o	Make final matches
	o	See that security clearances are started, where applicable
	o	(Mentors provide background reference material to chosen apprentices)
	o	Encourage enrichment activities: arrange for films, speakers, tours, etc.
May	o	Send letters to students and mentors re-opening session
	o	Send students Apprentice Handbook
June	o	Arrange general orientation for students and mentors
July, August	o	Administer and monitor apprenticeships
	o	Check on enrichment activities
	o	Distribute evaluation forms to students and mentors
September	o	Analyze evaluations
	o	Prepare final report to Air Force

In the near future the United States may face shortages of scientists and engineers in such fields as physics, electronic engineering, computer science, and aeronautical engineering. High school students are currently not selecting to prepare for careers in these areas in numbers large enough to match the projected need in the United States.

The Air Force faces "a formidable challenge - the acquisition and retention of the technological competence needed to ensure a strong national security, both in-house and in the industrial and academic base which supports defense preparedness." The Director of the Office and Science of Technology Policy in the Executive Office of the President in 1979 responded to this need by requesting the federal agencies to incorporate in their

contract research programs the mechanisms to stimulate career interests in science and technology in high school students showing promise in these areas. The Air Force High School Apprenticeship Program is an example of the response to this.

Under this program, UES placed the selected high school students in a wide variety of scientific and engineering fields at the participating Air Force Laboratories/centers. The students worked for an eight-week period during their summer vacations. UES provided all the support and administration to advertise the program, coordinate applications with the Air Force Laboratory mentors, made final selection of student-mentor matches for the summer, made payment to the students during their working period, and collected and coordinated the final reports from the students.

The Laboratories participating in the program, along with the number of high school students assigned to the laboratory is listed below.

Laboratory	Students
Aero Propulsion Laboratory Dayton, Ohio	7
Armament Laboratory Fort Walton Beach, Florida	16
Astronautics Laboratory Lancaster, California	10
Avionics Laboratory Dayton, Ohio	10
Engineering and Services Center Panama City, Florida	7
Flight Dynami s Laboratory Dayton, Ohio	12
Geophysics Laboratory Boston, Massachusetts	8
Harry G. Armstrong Aerospace Medical Research Laboratory Dayton, Ohio	8
Occupational and Environment Health Laboratory San Antonio, Texas	3
Rome Air Development Center Rome, New York	15
School of Aerospace Medicine San Antonio, Texas	7

There were a total of 103 participants in the program selected from 260 High School student applicants. The final report on the High School Apprenticeship Program is published under a separate report entitled <u>United States Air Force High School Apprenticeship Program 1989 Program Management Report</u>.

APPENDIX I

This appendix presents the following documents which were distributed to appointees and other program participants.

A. Information Brochure for Summer Fellows.

B. Questionnaire for participants and a summary of their replies.

C. Questionnaire for Air Force laboratory representative and a summary of their responses.

D. Questionnaire for participants research colleagues and a summary of their replies.

APPENDIX 1.A

INFORMATION BROCHURE

for

SUMMER FELLOWS

on the

1989 USAF-UES SUMMER FACULTY RESEARCH PROGRAM

March 1989

TABLE OF CONTENTS

I. SUMMER FELLOW OBLIGATIONS

Universal Energy Systems, Inc. (UES) is required by contract to impose certain obligations on you in your status as a Summer Fellow. This section outlines those obligations, and you should read them thoroughly. Your are required to sign and return the statement of understanding before the final processing of your appointment can be completed. The following is a list.

1. Pre-Summer Visit: A pre-summer visit to your research location is optional but has been of great value to previous participants in planning the summer research effort. Approval for such a trip may be granted upon written request to UES along with the concurrence of the Laboratory/Center representative. The purpose of this visit is to enable you to make your final plans for the summer research period if needed. Reimbursement is paid for allowable travel expenses incurred on a pre-summer trip as indicated in the Allowable Travel Expenses section (page 3) of this brochure. To be reimbursed, you must invoice for it as described in the Instructions for Invoicing for Compensation and Reimbursement section (page 5) of this brochure.

2. Research Goals and Objectives: A statement of research objectives must be provided to UES PRIOR TO the start of the summer research period. It should outline your goals and the approach you intend to follow in researching these goals. Neither travel expenses nor expense allowances will be reimbursed until after receipt of your statement of research objectives. The report should also clearly indicate the date of your first working day of the summer research period. In many cases, these will be finalized during the pre-summer visit.

3. Final Report: At the end of your summer research effort, you are required to submit to UES a completed, typewritten scientific report stating the objectives of the research effort, the approach taken, results, and recommendations. Information on the required report format will be sent to you with a "FINAL REPORT INFORMATION BULLETIN" and sample report illustrating a suggested format. The final report must first be approved by your Effort Focal Point and then transmitted so as to reach UES by Saturday, September 30, 1989. Payment of "Compensation" for the final two weeks of your ten-week research period cannot be made until UES has received and approved this report in the required format.

4. Program Evaluation Questionnaire: This critique form should be completed and returned to UES, along with your final report, by Saturday, September 30, 1989. The return of this form is a program requirement; it also must be received by UES before the final compensation payment can be made.

5. U.S. Air Force - Summer Fellow Relationship: The U.S. Air Force and UES understand and agree that the services to be delivered by Summer Fellows under this contract will be non-personal services and the parties recognize and agree that no employer-employee or master-servant relationships will exist between the U.S. Air Force and the Summer Fellows. Non-personal services are defined as work performed by an individual who is responsible for an end item, such as a report, free of supervision of the U.S. Air Force and free of an employer-employee relationship.

As a Summer Fellow, you will not:

(a) Be placed in a position where you are appointed or employed by a Federal Officer or are under the supervision, direction, or evaluation of a Federal Officer, military or civilian.

(b) Be placed in a staff or policy-making position.

(c) Be placed in a position of command, supervision, administration, or control over Air Force military or civilian personnel or personnel of other contractors or become a part of the U.S. Air Force organization.

The services to be performed under the SFRP do not require UES or the Summer Fellow to exercise personal judgement and discretion on behalf of the U.S. Air Force; rather, the Summer Fellows will act and exercise personal judgement and discretion on their research programs on the SFRP conducted by UES.

The Air Force will have unrestricted use of and access to all data developed during the period of this appointment.

II. ALLOWABLE TRAVEL EXPENSES

If you live outside of the area (50 miles) where you will be assigned for the summer program, the SFRP provides potential funding for two trips between your home and your assigned research location. As soon as you have signed and returned your appointment letter along with the budget sheet, you will be authorized to receive reimbursement for travel expenses as described below.

As outlined in the Summer Fellow Obligations section in this brochure, you may make a pre-summer visit in addition to the trip to and from your assigned research location for your summer effort. You are expected to make your own arrangements for these trips, and after the trips you may invoice UES for reimbursement of allowable expenses in the format described in the Instructions for Invoicing for Compensation and Reimbursement section of this brochure. Closely coordinate your travel plans with your FOCAL POINT.

All travel reimbursements under Summer Fellow appointments are made according to current UES policy, and deviations from the approved budget are not authorized and will not be reimbursed. In light of these restrictions, you may choose either to travel by common carrier at coach rates or less, by driving your private auto, or by a combination of both. (Please note that funding for rental cars requires ADVANCED WRITTEN approval by UES and UES will not reimburse this expense unless the prior written approval is obtained.) With any of these choices you may claim reimbursement up to the amount for the most direct routing, taking into the account the desirability of routing on interstate highways if you drive your private auto.

Reimbursement for direct route travel by common carrier will be paid on your submission of an invoice to UES following the invoicing instructions referenced above. In the view of the convenience of having a car at the research location, UES strongly recommends that a private auto be used for travel when practical. Reimbursement when you drive your private auto is at the rate of 20¢ per mile within the above routing restrictions and will be paid on submission of a suitably prepared invoice. These reimbursements cannot be extended to cover travel by your family if they accompany you on either of these authorized trips.

During the pre-summer visit, you will be authorized to claim a per diem reimbursement at the rate of $50.00 per day for a maximum of three days spent at your assigned research location outside of your area of residence. Instructions for claiming this per diem are also described in the Instructions for Invoicing for Compensation and Reimbursement section of this brochure.

During the ten week summer research period, you will be authorized to receive an expense allowance in lieu of a per diem payment at a rate of $42 per day for a maximum of 70 days. To receive this allowance, you must invoice for it and be living (50 miles) outside your area of residence.

These items above are the only reimbursable travel allowances authorized under the SFRP appointment. Any additional travel expenses incurred during the appointment period will be your personal responsibility.

15

UES has arranged with a travel office in Dayton, Ohio, to have the Air Fare costs of your travel on the SFRP charged directly to UES. For you to take advantage of this you must call this travel service. The number in Dayton, Ohio, is (513) 293-7444 or 1-800-628-6668. You must give the code SLI3 to have the tickets charged to UES. Please reference project 210 when ordering tickets.

III. INSTRUCTIONS FOR INVOICING FOR COMPENSATION AND REIMBURSEMENT

Attached is a copy of the Invoice Format that you are required to use to obtain compensation or reimbursement from UES. Note that all disbursements by UES for compensation, travel, and/or other expenses are subject to audit approval, so you must submit receipts substantiating charges invoiced.

In addition, you must prepare, sign, date and attach to each completed invoice a Brief Report of Effort

A. PREPARATION OF BRIEF REPORT OF EFFORT

Whenever you submit an Invoice for reimbursement to UES you must also include a brief report describing your activities for the invoice period. To meet this obligation, you must prepare, date, sign, and attach to your completed invoice a Brief Report of Effort describing the research accomplished on the appointment and explain any travel during the invoice period.

This report should describe innovative techniques and designs or discoveries which may be disclosed as patents. Rights to any inventions or discoveries shall reside with UES unless determined otherwise by the contracting agency.

The Brief report should never exceed one typewritten page and most often should be considerably shorter than one page.

B. PREPARATION OF INVOICE FORMAT

The financial items required on the Invoice Format are for COMPENSATION, TRAVEL, EXPENSE ALLOWANCE, AND PER DIEM.

Item (1)   SOCIAL SECURITY/MAILING ADDRESS

Fill in your name, social security number, and address to which you wish to have your check mailed.

Item (2)   COMPENSATION

(a)   Indicate the dates for which you are claiming compensation, and indicate the number of days you are claiming for compensation, this may include holidays, such as July 4.

(b)   Multiply this number by $124.00 and enter the total dollar amount in the blank total charges for service. The accumulated total number of days you claim on this appointment may not exceed the number authorized in your appointment letter.

Item (3)　TRAVEL

    (a)　Under the heading Date indicate the date you departed on your trip and the date you arrived at your destination. If you are invoicing for a round trip, also list the date you departed on your trip and the date you arrived home.

    (b)　Under the heading Dept/Arrival Time list the departure and arrival times for the corresponding days you listed under Date.

    (c)　List your destination under the heading Destination.

    (d)　Under the heading Mode, indicate your principal means of conveyance; i.e., commercial air, private auto, etc

    (e)　Under the heading Amount, itemized these expenditures for travel reimbursement. Continue them on a separate sheet if necessary.

    (f)　Total these travel items and enter the dollar amount for travel in this invoice on the line to the right of Total Travel Expense.

Item (4)　EXPENSE ALLOWANCE

This item on the invoice will be used to claim the $42 per day for reimbursement of per diem.

    (a)　In the first blank to the right of EXPENSE ALLOWANCE enter the number of days for which you are claiming the expense allowance at your assigned research location.

    (b)　Multiply this number by the daily allowance rate of $42.00 and enter this total dollar amount in the blank at the far right.

    (c)　Itemize the days for which you are claiming the Expense allowance reimbursement. It can include weekend days and holidays as well as regular work days. It does not apply to the pre-summer visit.

Item (5)　PER DIEM

This item will be used to claim reimbursement only for Per diem charges on the optional pre-summer visit. This cannot exceed three days; only days spent at the actual research site are allowed.

    (a)　In the first blank to the right of PER DIEM enter the number of days reimbursement being requested. This entry must correlate with an accompanying lodging receipt.

    (b)　Multiply this number by the $50.00 daily Per diem rate and enter the total dollar amount in the blank at the far right.

Item (6)   <u>INSTRUCTIONS</u>

You may combine reimbursement requests for compensation, travel, and Per diem or expense allowance in the same invoice. The total for all items invoiced should be indicated on the blank labeled "Total Amount of Bill" in the lower right hand side of line 6.

Item (7)   If you have arranged your travel through the UES travel office as described on page 4, please indicate the cost of the tickets on this line.

IMPORTANT: Indicate in the space provide on <u>each</u> invoice the address to which you want the check mailed.

You must sign and date your invoice in the space provided as "Summer Fellow" before it is submitted; you MUST also have your <u>Focal Point countersign</u> the invoice before it is mailed to UES. Your Focal Point is an Air Force individual at your research location who will be identified prior to your effort start date.

Invoices should be mailed to:

<div align="center">

Universal Energy Systems, Inc.
SFRP Office
4401 Dayton-Xenia Road
Dayton, Ohio 45432

</div>

IV
BILL FOR SERVICE

1. _____   _____
       Name (First, Initial, Last)   Social Security #

   _____
       Address (Street, City, Zip)

   SERVICE: SFRP Summer Fellow

   SERVICE AUTHORIZED BY:_Rodney C. Darrah_ RATE AUTHORIZED:$128.00/day

   This service is for:
       Project # _210_   Government Contract No. _F49620-87-R-0004_

2. DATES OF SERVICE: _____   TOTAL DAYS OF SERVICE ___
   TOTAL CHARGES FOR SERVICE: _____

   ADDITIONAL ITEMIZED REIMBURSABLE EXPENSES:
       (receipts required for expenditures over $25.00)

3. TRAVEL: DATE _____   DEPT/ARRIVAL TIME _____

   DESTINATION MODE _____   AMOUNT _____

4. EXPENSE ALLOWANCE: (___ days at $42.00/day) $_____

5. PER DIEM: (___ days at $50.00/day) (Pre Summer Visit) $_____

6. TOTAL AMOUNT OF BILL: _____

7. AIR FARE TICKETS CHARGED DIRECTLY TO UES   AMOUNT $_____

_____   _____
    Summer Fellow Signature - Date   Telephone

Invoice Approval: _____
              Effort Focal Point Signature

X_____   Brief Report of Effort
    Type or Print Name   Attached _____

Location: _____ Telephone: _____

Date: _____

Send bill to:
UNIVERSAL ENERGY SYSTEMS, INC.
ATTN: SFRP Office
4401 Dayton-Xenia Road
Dayton, Ohio 45432

In order for UES to provide quick turn around of your bills for service, we request your assistance in complying with the following schedule. The dates indicated are the dates your bills <u>MUST</u> be at UES. Please allow adequate mailing time for UES to receive your bills by the dates indicated
for 1989

<u>DATES BILLS MUST BE AT UES</u>	<u>DATES CHECKS WILL BE MAILED</u>
April 6, 21	April 17, May 1
May 8, 23	May 15, 30
June 8, 22	June 15, 30
July 6, 21	July 17, 30
August 8, 23	August 15, 30
September 8, 22	September 15
October 5, 23	October 2, 16, 31
	November 15, 30

For bills received on or before these dates, UES will be able to process checks to you in the mail by the 15th and 30th. For bills received after these dates, the checks may not be processed until the next pay period, causing a two week delay in your receiving your check.

Your bill may be for any period of time. It does <u>not</u> have to start on a Monday or end on a Friday. Your bill may be for any period convenient for you to meet our billing dates listed above. Please note these are the dates the bill must be at UES. For example, a bill received on or before April 6 will be mailed out to you on April 17. A bill received on April 7 will not be mailed until the April 21 bills are processed on May 1.

1988-89 RESEARCH INITIATION PROGRAM

As a participant in the 1989 Summer Faculty Research Program (SFRP) you are eligible to submit a proposal for the AFOSR RIP, as discussed in the 1989 SFRP Brochure.

To compete for a RIP award SFRP participants must submit a complete proposal and proposed budget either during or promptly after their SFRP appointment period. Each proposal will be evaluated for technical excellence, with a special emphasis on relevance to continuation of the SFRP effort, as determined by the Air Force Laboratory/Center. The most effective proposals are those closely coordinated with the SFRP Effort Focal Point and which follow the SFRP effort with proposed research having strong prospects for later sustained funding by the Air Force Laboratory/Center.

The maximum award under the RIP is $20,000 plus cost-sharing by your University/College.

The total funds available from AFOSR will limit the number of awards to approximately 75, or one-half of the 1989 SFRP participants. The final decision on funding a proposal is the responsibility of AFOSR.

The mechanics of applying for a RIP award are as follows:

(1) Program proposals for $20,000 plus cost-sharing must be submitted no later than November 1, 1989. Budgets must include, where applicable, Principal Investigator time, graduate assistant and support effort, equipment and expendable supplies, travel and per diem costs, conference fees, indirect costs, and computer charges. No special format is required, however cost sharing must be indicated on the budget if applicable.

(2) Proposals are evaluated and a final award decision is recommended by AFOSR after consultation with the Laboratory/Center.

(3) Subcontract awards will be negotiated with the employing institution, designating the individual as Principal Investigator, with the award period having a start date no earlier than October 1, 1988 and a completion date no later than December 31, 1989. The performance period of the research may not exceed one year. Employing institutions are encouraged to cost-share since this program is designed specifically as a research initiation procedure.

In summary, a RIP proposal must be:

        Technically excellent;
        A continuation of SFRP work:
        Received no later than November 1, 1988
        Budgeted not to exceed $20,000 plus cost-sharing
        Less than one year duration.

Proposals for the RIP should be transmitted to UES as soon as possible. Some awards may be made prior to the submission deadline. The first RIP awards are planned to be in effect during the month of December 1988. All awards are expected to be in effect shortly after the final submission deadline of November 1, 1988, with final negotiation with your University completed by January 1, 1989.

Send completed proposals to:

RESEARCH INITIATION PROGRAM
Universal Energy Systems, Inc.
4401 Dayton-Xenia Road
Dayton, Ohio 45432

APPENDIX 1.B

PARTICIPANTS' QUESTIONNAIRE REPLY SUMMARY

1. <u>Assignment in field of competency and/or interest?</u>   Yes - 165
                                                                        No -   0

2. <u>Reasonable choice of assignment?</u> Yes - 158
                                            No -   7

    <u>If no, why?</u>

    A few responded that the focal point had already formulated the project.   One
    indicated that the reorganization and cutbacks at the lab forced the research into
    a different area.

3. <u>Work challenging?</u>   Yes - 163
                               No -   2

    <u>If no, why?</u>

    One indicated monotonous work, another pointed to delays in receiving
    instrumentation that was ordered.

4. <u>Would you classify your summer effort as research?</u>   Yes - 159
                                                                        No -   5

    <u>Comments:</u>

    Two indicated that it was preliminary work to a research project.   One was involved
    in software development, another in systems development.

5. <u>Were your relations with colleagues satisfactory?</u>   Yes - 161
                                                                        No -   4
    <u>If no, why?</u>

    Lack of interaction with focal point.   One was not assigned to a technical person,
    another felt the focal point was using invalid statistics.

6. <u>Suggestions for improvement of relationships.</u>

    Better definition of the problem prior to arrival at the lab, more discussions, more
    seminars, larger RIP's, and earlier introduction to other SFRP'ers were mentioned.

7. <u>Were you afforded adequate facilities?</u>   Yes - 154
                                                             No - 11

<u>If no, why?</u>

A few listed the need for a computer or mainframe; a few indicated lack of space; several mentioned inadequate salary and/or per diem. One indicated no support - not even paper.

8. <u>Accomplishment in ten weeks?</u>   More than expected - 34
                                                 Less than expected - 29
                                                 About what expected - 102

9. <u>Will you continue this or related research efforts?</u>   Yes - 156
                                                                       No - 9

10. <u>Were you asked to present seminars?</u>   Yes - 85
                                                      No - 80

11. <u>Were you asked to participate in meetings?</u>   Yes - 98
                                                      No - 67

12. <u>Did you travel on behalf of the laboratory?</u>   Yes - 27
                                                      No - 138

13. <u>Did you participate in "special" meetings?</u>   Yes - 63
                                                      No - 101

14. <u>Please give other comments on extra activities.</u>

A few indicated that tours of the lab and discussions with the lab personnel expanded their understanding of the work requirements. One mentioned helping formulate a SOW; another designed test items outside of the research effort. Many mentioned the benefits of social activities, such as, picnics, barbecues, and dinners.

15.

	A (High) . . . D (Low)			
<u>Technically challenging?</u>	A-118	B-42	C-4	D-1
<u>Future research opportunity?</u>	A-135	B-22	C-6	D-2
<u>Professional association?</u>	A-126	B-37	C-1	D-2
<u>Enhancement of my academic qualifications?</u>	A- 82	B-73	C-9	D-1
<u>Enhancement of my research qualifications?</u>	A-107	B-51	C-3	D-2
<u>Overall value?</u>	A-133	B-31	C-1	D-0

B. ADMINISTRATIVE ASPECTS

1. <u>How did you first hear about this program?</u>

   Colleagues   - 45
   Advertisement - 16
   Air Force   - 18
   Direct Mail   - 86

2. <u>Decisive aspect of application?</u>

   <u>NOTE ON THIS QUESTION, APPLICANTS HAD MORE THAN ONE ANSWER</u>

   Area of possible future research funding   - 45
   Good research opportunity   - 112
   Opportunity to work with USAF   - 26
   Location   - 12
   Financial support   - 12
   Chance of publishable result   - 1
   Flexible research schedule   - 3

3. <u>Did the program timetable cause you any problems?</u>   Yes - 33
   No - 132

4. <u>Program information satisfactory?</u> Yes - 139
   No - 26

5. <u>Did you have problems in domestic aspects?</u>   Yes - 26
   No - 136

   <u>If yes, explain.</u>

   Problems with short term housing was most often mentioned. A few indicated problems cashing checks. Some mentioned no social activities. A few mentioned problems with pay. A few mentioned cost of family travel. One said it was too hot. Another indicated problems with child care.

6. <u>Stipend level?</u>   Generous - 13
   Adequate - 101
   Meager   - 51

7. <u>Travel reimbursement?</u>   Adequate   - 120
   Inadequate - 31
   N/A   -

8. Pre-program visit?   Essential   - 103
                                Convenient   - 33
                                Not worth expense - 5
                                N/A   -

9. Housing information?   VOQ   - 14
                                Apartment - 91
                                Other   - 60

10. Mailing list suggestions?

Department chairman, department deans, ASEE bulletin, Science, Nature, Chronicle of Higher Education.

11. Addition of Graduate Student Program increased effectiveness of program?
NOTE THAT NOT EVERY FACULTY MEMBER HAD A GRADUATE STUDENT WORK WITH THEM, THEREFORE, THEY DID NOT ANSWER THIS QUESTION.
                    Yes - 106
                    No - 12

12. Did a student work with you?   Yes - 51
                                          No - 114

13. Program administration overall rating?   Excellent - 105
                                              Good   - 53
                                              Fair   -   7
                                              Poor   -   0

14a. Comments on the strong points of the program:

Many comments concerned the opportunity to be exposed to Air Force research and the broad range of topics involved. A major point was the possibility of future research opportunities. The interaction with Air Force researchers and exposure to fresh ideas was important. The opportunity to expand their background was mentioned several times. The opportunity to work with state-of-the-art equipment/facilities/computers was mentioned. Excellent technical library. The freedom to pursue research with no classes and no students was mentioned. The GSRP and RIP are viewed as important parts of the SFRP. The opportunity for a pre-summer visit to establish research objectives and housing arrangements were mentioned. The administration of the program was highlighted including the responsiveness, accessibilities and level of support for both UES and Air Force personnel. A UES coordinator was mentioned as an enhancement to the program. A couple mentioned the opportunities for small school faculty to participate in SOTA research. One mentioned the opportunity to be of "service to country".

14b. <u>Comments on the weak points of the program:</u>

Inadequate pay was frequently mentioned, also problems with housing. The tax concerns were seen as a negative. Many indicated that period was too short. Some complained of the paperwork and the UES administration. A few mentioned the final report requirement and the limitation of 20 pages. A few mentioned being apart from family. Some indicated the lab mission was too focused. Several indicated the SFRP is not well known at the universities. Too few RIP's were mentioned. One indicated transportation difficulties, another complained of non-academic research. Many of the weaknesses mentioned were specific to the research involved.

15. <u>Has this been a fruitful, worthwhile, constructive experience?</u>

        Yes - 164
        No -   0

16. <u>Other Remarks.</u>

The program received praise in general. Words such as outstanding, productive, excellent were used. Allowing longer than 10 weeks was often mentioned. The opportunity to interact with Air Force researchers was highlighted. A few suggested a tour/get together at the beginning of the effort. An HBCU participant indicated intention of using RIP to establish an Aviation Psychology Lab at the university.

r:\wp\deb\fac\combined.sum

APPENDIX 1.C

LABORATORY REPRESENTATIVE'S QUESTIONNAIRE REPLY SUMMARY

1989 USAF/UES SUMMER FACULTY RESEARCH PROGRAM
EVALUATION QUESTIONNAIRE LABORATORY REPRESENTATIVE

1. How do you rate the correspondence, verbal and telephone communication, and other aspects concerning program administration?

Excellent   - 9
Good   - 8
Average   - 3
Poor   - 0
No Response - 0

How could it be improved?

Correspondence and communications are rated highly acceptable for this program. The only suggestion for improvement demonstrates general unfamiliarity with this program and may be an isolated instance. Recommendation: Follow up with each assignment to assure that all participants know what their responsibilities are and the responsibilities of those directly involved. This should be done early and may be at the risk of repetition.

2. Did you have sufficient time to conduct an evaluation of applications?

Yes - 17
No - 2

Comments?

The answers to question #2 suggests that adequate time is presently available to evaluate applicants and no change is indicated.

3. Was the number of faculty researchers assigned to your organization satisfactory?

Yes -   11
No -   6
No Answer 1

If no, how many would be desired?

The number of faculty researchers is presently right for most organizations. These organizations would like the number to be based on the number of divisions in the Laboratory. The limit on numbers should be defined by the cost and available funds. The Weapons Lab suggested that the laboratory should have the option of funding additional faculty researchers.

4. <u>Please rate the expense-paid pre-program visit:</u>

Essential   - 18
Convenient   - 1
Not worth expense   -
No answer   - 1

The pre-program visit is essential to the success of the program and should continue.

5. <u>In your opinion, is the ten week period an optimum length of time to develop a viable working relationship among the faculty researchers, students, laboratory/center personnel and program?</u>

Yes -   10
No -   8
N/A -   2

<u>Other comments:</u>

Most will agree that the researchers will use all the time they are given. Ten weeks is apparently minimally acceptable, especially considering the mini-grant program. Twelve would be better and would allow one week to get organized and a week for report writing.

6. <u>Did your laboratory/center establish a seminar program, or other means, to "tap" the faculty associate's academic knowledge other than his research assignment?</u>

Yes -   9
No -   9
No Answer 2

<u>If yes, give description and evaluation?</u>

The means of access to knowledge of visiting faculty was not well developed by the laboratories. Though the seminar is a popular means, it was not used very much. Some emphasis is needed if this aspect is important. One idea from two of the labs included a session during lunch, as often as weekly, to bring participants and lab personnel together. The School of Aerospace Medicine used "brown bag" lunches on Wednesdays. This seems to take the least amount of planning and preparation and is least cumbersome.

7. Did the laboratory/center conduct a general briefing, tour, and/or other formal means of welcome and introduction for the associate assigned to your organization?

Yes - 15
No - 5

Most of the laboratories provided some welcome and introduction to the faculty. Recommend that the local coordinator be provided the challenge to welcome each of the associates and suggest that the focal points be responsible to the associate for introduction to the technical area. This is most likely being done, but not as part of a "formal" welcome.

8. Did you have a formal exit exercise for each associate such as a final technical briefing presented to the organization management, a private interview, or other?

Yes - 13
No - 6
No Answer 1 (varied by division)

There was a formal outbrief most of the time. One comment indicated these interviews were accomplished in the division.

9. In your opinion, what was the overall quality of this year's participants as measured by attitude, technical competence, work habits, production and meaningful research accomplishment?

Superior - 48
Excellent - 62
Average - 6
Poor - 1

Most of the participants were rated excellent or superior. Only one participant was rated "poor" with no other comment.

10. Do you believe the Graduate Student Research Program enhances the Summer Research Program?

Yes - 19
No -
N/A - 1

The Graduate Student Research Program is considered a valuable part of the Summer Research Program and should continue.

11. <u>Was a student assigned under the Graduate Student Research Program to your laboratory this summer?</u>

Yes -   19
No -
N/A -   1

<u>If so, was their participation productive?</u>

Yes -   18
No -

See comment on question #10 above.

12. <u>Please furnish any recommendations you may have on improving the Graduate Student segment of the program.</u>

A summary of the various comments received include:

1. Need to advertise in the student magazines (e.g. American Institute or Aeronautics and Astronautics, Student Journal, 370 L'Enfant Promenade,SW, Wash,D.C.).
2. Better to have graduate student accompany faculty member.
3. Try to coordinate specific thesis interest.
4. Give clear instructions on program and contacts in labs.
5. Have the local UES coordinator contact each student with area information before their site visit.
6. Program went well. Had four graduate students accompanied by faculty. Better for them and better for us.

13. <u>Site visits were made by Program Director and/or Administrator and the AFOSR representative. Do you feel these visits are beneficial to the program participants and Laboratory in understanding the management of the program?</u>

Yes -   15
No -   1
N/A -   4

<u>Do you think these visits should be done again next year?</u>

Yes -   15
No -   1

There was overwhelming support for visits by AFOSR and UES. Visits were beneficial and should be continued.

14. <u>UES has a coordinator assigned at your base to assist the Summer Faculty participants in the administration of the program. Did you find this beneficial to the program?</u>

Yes - 11
No - 1
N/A - 8

Where a coordinator is assigned, he\she was beneficial.

<u>Are there any problem areas coordinators should administer in future years?</u>

Improvement in the communication with the participants is still indicated in some instances. Also, the coordinator could possibly negotiate for some dormitory space in local universities/colleges during the summer, especially where housing is not really affordable.

15. <u>Please furnish any other comments or suggestions to improve the program in future years.</u>

1. This program is beneficial to all.
2. One significant source indicated shortage of engineering expertise and suggested that if pay is the reason, something should be done to increase the pay.
3. Some of the comments indicate frustration with paperwork. (One respondent indicated that they were merely the distribution point and another claimed the program was using an inadequate questionnaire.)

r:\wp\deb\fac\labquest\labreps.sum

APPENDIX 1.D

PARTICIPANTS RESEARCH COLLEAGUES QUESTIONNAIRE REPLY SUMMARY

1989 USAF/UES SUMMER FACULTY PROGRAM
EVALUATION QUESTIONNAIRE
(TO BE COMPLETED BY PARTICIPANT'S TECHNICAL FOCAL POINT)

A. TECHNICAL ASPECTS

1. Did you have personal knowledge of the associate's capabilities prior to his arrival at work site?
   YES - 93
   NO - 48

   If yes, where/what/how?

   28 - Indicated from prior professional interactions.
   22 - Indicated the associate was a prior participant.
   20 - Indicated from the application (resume) on pre-summer visit.
   A few indicated they knew associate as a graduate student.

2. Was the faculty associate prepared for his project?
   YES - 136
   NO - 5

3. Please comment on his/her preparedness, competency, scope, depth of knowledge of subject area:

   Responses in general indicated that the associate was well prepared for the effort. Typical responses indicated excellent, outstanding, world class, etc. Several indicated that the pre-summer visit assisted in the associate being prepared for the assignment. A few indicated that the associate was involved in a new application or had a weak background in the specific application and needed time to get up to speed; but in these cases, the associates were eager, willing and rapid learners. In one case, a program cancellation required a realignment of work which met with less than total success. Only one respondent indicated the professor was not prepared for the research assignment.

4. Please comment on the associate's cooperativeness, diligency, interest, etc.

   Without exception, the professor received high marks in these areas. Typical responses indicated excellent, exemplary, hard-working, cooperative, diligent, excited, outstanding, enthusiastic, etc.

5. In your opinion, has his participation in this summer program contributed to an increase in the associate's potential to perform research?
YES - 134
NO - 7

Comments:

A large number indicated that the participation has acquainted the participant with the problems facing the Air Force research. Several indicated the publication/presentation of results. The associate's involvement with broadened applications, new ideas, new areas of interest, and practical applications was also mentioned. A few mentioned that because of the universities lack of facilities, or the associate's teaching load, the summer effort allowed them to experience new equipment and resources. A few mentioned the gain in understanding of how to conduct research with a government laboratory. The negative replies indicated the associate came into the summer program as an accomplished, experienced researcher.

6. Did work performed by the associate contribute to the overall mission/program of your laboratory?
YES - 136
NO - 4

If yes, how?

Responses indicated that the associate broadened the area of knowledge; provided new/better methods/directions for the research. The associate developed key software and databases for the programs. In some cases, the fresh view provided by the associate helped to advance the research capabilities. A few indicated the establishing of a theoretical foundation. One indicated that the added manpower for 10 weeks was a major contribution.

7. Would you classify the summer effort under SFRP as research?
YES - 130
NO - 10

Comment:

Most answered that the effort was clearly research. One indicated 50% research, 50% consulting, another indicated that a model development was the focus of the effort. A few indicated that background studies/literature searches for future research were accomplished.

8. Was a graduate student assigned to your group this summer?
YES - 48
NO - 92

38

If so, did this enhance the research productivity?
YES - 40
NO - 10

Was it an administrative burden?
YES - 0
NO - 49

9. Were your relations with the associate satisfactory from a technical point of view?
YES - 136
NO - 4

Suggestions as to how they might be improved?

Few comments were received concerning improvements. Most suggestions indicated a need for improved communications, either prior to the summer start or during the effort.

10. Do you think that by having a faculty associate assigned to your group, others in the group benefited and/or were stimulated by his presence?
YES - 130
NO - 11

Comments:

Most comments centered on the exchange of ideas through discussions, lectures and seminars. Several mentioned the positive impact on the laboratory's junior scientists/engineers. On the negative side, insufficient time and the isolation of the associate were mentioned.

11. Do you feel that introduction to each other, together with the summer work experience and performance could form a sound basis for continuation of effort by associate at his home institute?
YES - 130
NO - 10

If yes, how?

Several methods were suggested, i.e., RIP, research proposal to AFOSR, BAA contract, SBIR, grant to university, direct contract, IPA, SFRP appointment, lab funding, travel funds, etc. However, many of those indicating an interest to continue the effort did not suggest a funding mechanism for this.

If no, why not?

A few indicated the associate's background or research abilities were not up to laboratory standards. A few indicated that the associate's university lacks the equipment needed to support continued research in the area.

12. One of the objectives of this program is to identify sources of basic research capability and availability to the USAF. On a scale of A to D, how effective do you think this program will be in that respect?
(high) A B C D (low)
                    A   66   B   67   C   6   D   2

13. Also, please evaluate:

Evaluation of the following three areas ranged from high (A) to low (D) with the following breakdown:

Opportunity to stimulate group activity	A-79 B-53 C-8 D-1
Professional association	A-96 B-39 C-6 D-0
Program administration	A-75 B-57 C-9 D-2

B. ADMINISTRATIVE ASPECTS

1. When did you first hear of this program?

Most indicated that they have been aware of the program for several years. About 15 indicated this year is the first time they have heard of the program.

2. Were you involved in the screening and prioritizing of the faculty applicants for your lab?
YES - 98
NO - 42

If yes, do you have any suggestions for improvement of the procedures used?

The involvement of the technical focal point in the evaluations varied widely from lab to lab. In at least one case, the focal point first found out about the applicant upon his arrival for the 10 week effort. Several suggested that more time in evaluation was needed.

3. How do you rate the importance of the expense-paid pre-program visit to the work site?
Not worth expense - 3
Convenient   - 31
Essential   - 98

Please add any comments:

40

A couple indicated arrangements could be made by telephone. Most saw the visit needed to arrange plans for the summer effort, housing, and ordering supplies. Several mentioned that a one week stay would be helpful. Several indicated that if it is a returning participant, the trip is helpful, but not necessary.

4. Considering the calendar "window" of ten weeks (limited by varying college and university schedules), please comment on the program length. Were you as a team able to accomplish:

    more than   - 23
    less than   - 19
    about what you expected - 99

    Comments:

    Several indicated that 10 weeks is too short, but better than none.

5. Would you desire another faculty associate to be assigned to you and/or your group division?

    YES - 139
    NO   - 1

    If no, why not?

    Space limitations.

6. Would you desire additional graduate students in this program?

    YES - 92
    NO   - 26
    N/A -

7. Should the graduate students only be assigned to research with the summer research faculty member?

    YES - 48
    NO   - 72
    N/A -

8. Should graduate students continue to be assigned without summer research faculty supervision?

    YES - 75
    NO   - 35
    N/A -

9. <u>Other remarks:</u>

Most remarked on the excelling of the program indicating it was a good experience and mentioned it was cost effective. Several indicated they would like to see the program expanded. Other suggestions included:

1. Pre-summer visit for Graduate Student Research Program.
2. Pay for additional travel.
3. Lengthen stay beyond 10 weeks.

A few mentioned that the RIP mini grant was too small. A couple mentioned that the pay was too low; and that the program needed pay levels corresponding to participant's experience. One thought the questionnaire was vague and contained sexist wording.

r:\wp\fac\labquest\combfoc.que

APPENDIX II

A. Program Statistics

B. List of 1989 Participants

C. Participant Laboratory Assignments

APPENDIX II A

Summer Faculty Research Program

Sponsored by
Air Force Office of Scientific Research

Conducted by
Universal Energy Systems, Inc.

Program Statistics

1. <u>Applications Received</u> (by Laboratory)

Organization		Choice			
		1st	2nd	3rd	Total
Aerospace Medical Research Laboratory	(WPAFB)	37	20	16	73
Aero Propulsion Lab.	(WPAFB)	35	36	9	80
Armament Laboratory	(Eglin)	13	20	20	53
Arnold Engineering Development Center	(Arnold)	17	10	4	31
Astronautics Laboratory	(Edwards)	40	26	20	86
Avionics Laboratory	(WPAFB)	16	15	9	40
Engineering and Services Center	(Tyndall)	33	26	12	71
Electronic Systems Div.	(Hanscom)	14	10	5	29
Eastern Missile and Space Center	(Patrick)	3	2	8	13
Flight Dynamics Lab.	(WPAFB)	41	22	15	78
Frank J. Seiler Research Laboratory	(USAFA)	13	17	15	45
Geophysics Laboratory	(Hanscom)	26	13	6	45
Human Resources Lab. (Williams, Brooks and WPAFB)		38	34	22	94
Materials Laboratory	(WPAFB)	45	18	15	78
Occupational and Environment Health Lab.	(Brooks)	17	17	6	40
Rome Air Development Ctr.	(Griffiss)	62	43	23	128
School of Aerospace Med.	(Brooks)	36	23	15	74
Wilford Hall Medical Ctr.	(Lackland)	12	13	14	39
Weapons Laboratory	(Kirtland)	37	31	18	86
Late Applications		38			
Totals		573	396	252	

2. <u>Number of Participants</u> - 168

Number with Bachelors Degree	- 0
Number with Masters Degree	- 13
Number with Doctorate Degree	- 155

3. <u>Academic Ranking</u>

Assistant Professor	- 73
Associate Professor	- 40
Chairman	- 2
Instructor	- 4
Lecturer	- 1
Professor	- 47
Researcher	- 1

4.   Number of Participants at Each Laboratory

Organization

Aerospace Medical Research Laboratory	(WPAFB)	12
Aero Propulsion Laboratory	(WPAFB)	10
Armament Laboratory	(Eglin)	9
Arnold Engineering Development Ctr.	(Arnold)	10
Astronautics Laboratory	(Edwards)	12
Avionics Laboratory	(WPAFB)	7
Eastern Space & Missile Center	(Patrick)	0
Electronic Systems Division	(Hanscom)	3
Engineering and Services Center	(Tyndall)	11
Flight Dynamics Laboratory	(WPAFB)	9
Frank J. Seiler Research Laboratory	(USAFA)	7
Geophysics Laboratory	(Hanscom)	12
Human Resources Laboratories	(Brooks)	12
Materials Laboratory	(WPAFB)	9
Occupational & Environment Health Lab.	(Brooks)	4
Rome Air Development Center	(Griffiss)	15
School of Aerospace Medicine	(Brooks)	17
Weapons Laboratory	(Kirtland)	8
Wilford Hall Medical Center	(Lackland)	1
	Totals	168

5. Discipline Represented -

Aerospace Engineering	-	3	Geophysics	-	2
Aerospace Mechanics	-	1	Human Performance	-	1
Analytical Chemistry	-	2	Industrial Engineering	-	2
Animal Physiology	-	1	Inorganic Chemistry	-	2
Anthropology	-	1	Linguistics	-	1
Applied Mathematics	-	4	Management Science	-	2
Applied Mechanics	-	1	Material Science	-	3
Biochemical Eng.	-	1	Mathematics	-	7
Biochemistry	-	1	Mechanical Engineering	-	21
Biology	-	1	Microbiology	-	3
Biomedical Engineering	-	2	Molecular Biology	-	1
Biophysics	-	1	Nuclear Engineering	-	2
Biostatistics	-	1	Nuclear Physics	-	1
Chemical Engineering	-	2	Operations Research	-	1
Chemistry	-	6	Optical Engineering	-	1
Civil Engineering	-	7	Organic Chemistry	-	3
Computer Science	-	4	Pharmacology	-	1
Control Systems	-	1	Philosophy	-	1
Education Psychology	-	2	Physical Chemistry	-	5
Electrical Engineering	-	23	Physics	-	18
Engineering	-	3	Psychology	-	8
Environment Eng.	-	1	Robotics	-	1
Environment Philosophy	-	1	Sociology	-	1
Exercise Science	-	1	Statistics	-	2
Experiment Psychology	-	2	Toxicology	-	1
Fluid Mechanics	-	2	Zoology	-	1
Functional Analysis	-	1			

6. <u>Colleges and Universities Represented</u> - Total 118

Akron, University of	- 1	Mercer University	- 1
Alabama, University of	- 2	Mercyhurst College	- 1
Alfred University	- 2	Miami, University of	- 1
Arizona, University of	- 1	Michigan, University of	- 1
Arkansas State University	- 1	Minnesota-Duluth, Univ. of	- 2
Arkansas, University of	- 1	Mississippi State Univ.	- 2
Arkansas-Pine Bluff	- 1	Mississippi, Univ. of	- 1
Auburn University	- 1	Missouri-Columbia, Univ. of	- 2
Bethel College	- 1	Missouri-Rolla, Univ. of	- 2
Boston College	- 2	Moorhead State University	- 1
Brescia College	- 1	Morehouse College	- 1
California Polytechnic	- 1	Morris College	- 1
California State University	- 3	Murray State University	- 1
Carnegie Mellon University	- 1	Nebraska-Lincoln, Univ. of	- 2
Central State University	- 2	New Hampshire, Univ. of	- 1
Cincinnati, University of	- 3	New York Inst. of Tech.	- 1
Clarkson University	- 1	New York, State Univ. of	- 2
Clemson University	- 1	North Carolina Central Univ.	- 1
Colorado-Denver, Univ. of	- 2	North Carolina State Univ.	- 1
Cornell University	- 1	North Dakota State Univ.	- 1
Dayton, University of	- 2	Northern Arizona Univ.	- 2
Eastern Kentucky University	- 1	Northern Colorado Univ.	- 1
Eastern New Mexico Univ.	- 2	Northern Illinois Univ.	- 1
Eastern Washington Univ.	- 1	Northwestern State Univ.	- 1
Elizabeth City State Univ.	- 1	Northwestern University	- 1
Florida Atlantic University	- 1	Notre Dame University	- 1
Florida Inst. of Technology	- 2	Ohio State University	- 3
Florida, University of	- 4	Oklahoma, University of	- 4
Fort Hays State University	- 1	Old Dominion University	- 1
Grambling State University	- 1	Oregon Inst. of Technology	- 1
Greenville College	- 1	Pennsylvania State Univ.	- 1
Hamilton College	- 2	Pittsburgh, Univ. of	- 1
Harvard University	- 1	Purdue University	- 1
Howard University	- 1	Rennsselaer Polytech. Inst.	- 1
Huntingdon College	- 1	Rhode Island, Univ. of	- 1
Illinois Inst. of Technology	- 1	Saint Paul's College	- 1
Illinois State University	- 2	San Diego State Univ.	- 1
Illinois, University of	- 2	San Jose State Univ.	- 2
Indiana University	- 1	Savannah State College	- 1
Indiana-Purdue, Univ. of	- 1	Scranton, University of	- 1
Jackson State University	- 1	Seattle Pacific College	- 1
Kansas State University	- 2	Southeastern Mass. Univ.	- 1
Lawrence Tech. University	- 1	Southern Illinois Univ.	- 1
Long Island University	- 1	Southern Oregon State	- 2
Louisiana Tech. University	- 1	Southern University	- 1
Lowell, University of	- 1	Southwest Texas State Univ.	- 1
Massachusetts, Univ. of	- 2	Stevens Instit. of Tech.	- 1

6. <u>Colleges and Universities Represented (Continued)</u>

Syracuse University	- 1	Utica College	- 1
Tennessee State University	- 1	Vanderbilt University	- 1
Tennessee Tech. University	- 1	Virginia Polytechnic Inst.	- 1
Texas A&M University	- 7	Washington State University	- 1
Texas Lutheran College	- 1	West Virginia Tech.	- 1
Texas Southern University	- 1	West Virginia University	- 2
Texas Tech. University	- 1	Western Illinois University	- 1
Texas-San Antonio, Univ. of	- 3	Wisconsin-Platteville, Univ.	- 1
Transylvania University	- 1	Wittenberg University	- 1
Trinity University	- 2	Worcester Polyt. Instit.	- 1
U.S. Naval Academy	- 1	Wright State University	- 7
Utah State University	- 1	Wyoming, University of	- 1

Total   168

7. States Represented - Total 39

Alabama	-	4
Arizona	-	2
Arkansas	-	3
California	-	7
Colorado	-	3
Florida	-	8
Georgia	-	3
Illinois	-	9
Indiana	-	4
Kansas	-	3
Kentucky	-	5
Louisiana	-	4
Maryland	-	2
Massachusetts	-	8
Michigan	-	2
Minnesota	-	3
Mississippi	-	4
Missouri	-	4
Nebraska	-	2
New Hampshire	-	1
New Jersey	-	1
New Mexico	-	3
New York	-	13
North Carolina	-	3
North Dakota	-	2
Ohio	-	18
Oklahoma	-	4
Oregon	-	3
Pennsylvania	-	5
Rhode Island	-	1
South Carolina	-	2
Tennessee	-	3
Texas	-	16
Utah	-	1
Virginia	-	3
Washington	-	3
West Virginia	-	3
Wisconsin	-	2
Wyoming	-	1

8. Age of Participants -

Average -   44

APPENDIX II B

LIST OF PARTICIPANTS

LIST OF 1989 PARTICIPANTS

NAME/ADDRESS   DEGREE, SPECIALTY, LABORATORY ASSIGNED

Thomas Abraham   Degree: MS
Instructor   Specialty: Mathematics
Saint Paul's College   Assigned: School of Aerospace Medicine
Sci. & Math. Dept.
Lawrenceville, VA 23868
804\848-3111

Charles Alajajian   Degree: PhD
Assistant Prof.   Specialty: Electrical Eng.
West Virginia University   Assigned: Rome Air Development Center
PO Box 6101
Morgantown, WV 26506
304\293-6371

Barbara Alvin   Degree: PhD
Associate Prof.   Specialty: Biostatistics
Eastern Washington Univ.   Assigned: Occupational & Environmental
Math Dept. #32   Health Laboratory
Cheney, WA 99004
509\359-2203

Jon Anderson   Degree: PhD
Assistant Prof.   Specialty: Civil Engineering
Texas Tech. University   Assigned: Engineering & Services Center
PO Box 4200
Lubbock, TX 79409
806\742-3538

Peter Armendarez   Degree: PhD
Professor   Specialty: Physical Chemistry
Brescia College   Assigned: Armament Laboratory
7th at Frederica
Owensboro, KY 42301
502\686-4285

Pradip Bakshi   Degree: PhD
Professor   Specialty: Theoretical Physics
Boston College   Assigned: Geophysics Laboratory
Physics Dept.
Chestnut Hill, MA 02167
617\552-3585

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

William Bannister
Professor
Lowell, University of
Dept. of Chemistry
Lowell, MA 01854
508\452-5000

Degree: PhD
Specialty: Organic Chemistry
Assigned: Engineering & Services Center

Beryl Barber
Assistant Prof.
Oregon Institute of Tech.
3201 Campus Dr.
Klamath Falls, OR 97601
503\882-3899

Degree: MS
Specialty: Electronic Engineering
Assigned: Electronic Systems Division

Brian Beecken
Assistant Prof.
Bethel College
3900 Bethel Dr.
St. Paul, MN 55112
612\638-6334

Degree: PhD
Specialty: Physics
Assigned: Arnold Engineering Development Center

Christopher Bell
Assistant Prof.
Illinois State Univ.
133 Stevenson
Normal, IL 61761
309\438-8338

Degree: PhD
Specialty: Psychology
Assigned: Human Resources Laboratory: Manpower & Personnel Div.

Kevin Bennett
Assistant Prof.
Wright State University
309 Oelman Hall
Dayton, OH 45435
513\873-2444

Degree: PhD
Specialty: Applied Psychology
Assigned: Human Resources Laboratory: Logistics & Human Factors

Emerson Besch
Professor
Florida, University of
Box J-144 JHMHSC
Gainesville, FL 32610
904\392-1841

Degree: PhD
Specialty: Animal Physiology
Assigned: Engineering & Services Center

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

Robert Blystone
Professor
Trinity University
715 Stadium Dr.
San Antonio, TX 78284
512\736-7231

Degree: PhD
Specialty: Zoology
Assigned: School of Aerospace Medicine

Karren Brito
Research Chem.
Dayton, University of
300 College Park
Dayton, OH 45469
513\229-3118

Degree: PhD
Specialty: Chemistry
Assigned: Materials Laboratory

Lee Britt
Instructor
Grambling State University
Dept. of Physics
Grambling, LA 71245
318\274-2575

Degree: MS
Specialty: Physics
Assigned: Arnold Engineering Development Center

Joseph Brown
Professor
Mississippi State Univ.
PO Brawer ME
Mississippi State, MS 39762
601\325-7310

Degree: PhD
Specialty: Mechanical Engineering
Assigned: Armament Laboratory

Roger Bunting
Professor
Illinois State University
Dept. of Chemistry
Normal, IL 61761
309\438-7661

Degree: PhD
Specialty: Inorganic Chemistry
Assigned: Armament Laboratory

Larry Byrd
Assistant Prof.
Arkansas State University
PO Box 1080
State University, AR 72467
501\972-2088

Degree: PhD
Specialty: Mechanical Engineering
Assigned: Flight Dynamics Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED	

Anthony Carlisle
Assistant Prof.
Huntingdon College
1500 E. Fairview Ave.
Montgomery, AL 36194
205\265-0511

Degree: MS
Specialty: Computer Science
Assigned: Engineering & Services Center

Carolyn Caudle-Alexander
Assistant Prof.
Tennessee State University
3500 John A. Merritt Blvd.
Nashville, TN 37209
615\320-3115

Degree: PhD
Specialty: Microbiology
Assigned: School of Aerospace Medicine

James Chambers
Associate Prof.
Texas-San Antonio, Univ.
Brain Research Lab. of
  Biochemistry
San Antonio, TX 78285
512\691-5477

Degree: PhD
Specialty: Biochemistry
Assigned: School of Aerospace Medicine

Satish Chandra
Assistant Prof.
Kansas State Univ.
Dept. of Elec. and Comp. Eng.
Manhattan, KS 66506
913\532-5600

Degree: PhD
Specialty: Electrical Engineering
Assigned: Armament Laboratory

Chi Chen
Professor
Southeastern Mass. Univ.
Dept. of Elect. & Comp. Eng.
North Dartmouth, MA 02747
508\999-8475

Degree: PhD
Specialty: Electrical Engineering
Assigned: Geophysics Laboratory

David Choate
Assistant Prof.
Transylvania University
Dept. of Mathematics
Lexington, KY 40508
606\233-8237

Degree: PhD
Specialty: Mathematics
Assigned: Avionics Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

Ajit Choudhury
Associate Prof.
Howard University
Dept. of Electrical Eng.
Washington, DC 20059
202\636-6593

Degree: PhD
Specialty: Electrical Engineering
Assigned: Electronic Systems Division

Derald Chriss
Assistant Prof.
Southern University
PO Box 10572
Baton Rouge, LA 70813
504\771-3990

Degree: MS
Specialty: Chemistry
Assigned: Engineering & Services Center

Donald Chung
Associate Prof.
San Jose State Univ.
Dept. of Mat. Eng.
San Jose, CA 95192
408\924-3873

Degree: PhD
Specialty: Material Science
Assigned: Materials Laboratory

Mingking Chyu
Assistant Prof.
Carnegie Mellon University
Dept. of Mechanical Eng.
Pittsburgh, PA 15213
412\268-3658

Degree: PhD
Specialty: Mechanical Engineering
Assigned: Aero Propulsion Laboratory

David Cicci
Assistant Prof.
Auburn University
162 Wilmore Laboratories
Auburn, AL 36849
205\826-4874

Degree: PhD
Specialty: Aerospace Engineering
Assigned: Armament Laboratory

Brian Circelli
Assistant Prof.
Mississippi, Univ. of
Dept. of Chemical Eng.
University, MS 38677
601\232-5347

Degree: PhD
Specialty: Chemical Engineering
Assigned: Arnold Engineering Development Ctr.

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

Jerry Clark
Assistant Prof.
Wright State Univ.
Dept. of Physics
Dayton, OH 45435
513\873-2954

Degree: PhD
Specialty: Physics
Assigned: Aero Propulsion Laboratory

Stephen Cobb
Assistant Prof.
Murray State University
Dept. of Physics
Murray, KY 42071
502\762-6186

Degree: PhD
Specialty: Physics
Assigned: Arnold Engineering Development Ctr.

Kathryn Cochran
Assistant Prof.
Northern Colorado, University
Div. of Res., Eval., & Devel.
Greeley, CO 80639
303\351-2807

Degree: PhD
Specialty: Educational Psychology
Assigned: Human Resources Laboratory:
Manpower & Personnel Division

R. H. Cofer
Professor
Florida Institute
150 W. University Blvd.
Melbourne, FL 32901
407\984-5689

Degree: PhD
Specialty: Electrical Eng.
Assigned: Avionics Laboratory

George Coleman
Instructor
Elizabeth City St. University
Dept. of Mathematics
Elizabeth City, NC 27909
919\335-3487

Degree: MS
Specialty: Applied Mathematics
Assigned: Armament Laboratory

Kenneth Cornelius
Assistant Prof.
Wright State Univ.
Dept. of Mechanical Eng.
Dayton, OH 45435
513\873-3682

Degree: PhD
Specialty: Fluid Mechanics
Assigned: Flight Dynamics Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

Mark Cornwall
Assistant Prof.
Northern Arizona Univ.
POB 15105
Flagstaff, AZ 86011
602\523-1606

Degree: PhD
Specialty: Human Performance
Assigned: School of Aerospace Medicine

Larry Crum
Professor
Wright State University
Dept. of Comp. Sci. & Eng.
Dayton, OH 45435
513\259-1342

Degree: PhD
Specialty: Electrical Engineering
Assigned: Avionics Laboratory

Kenneth Currie
Assistant Prof.
Kansas State Univ.
228 Durland Hall
Manhattan, KS 66506
913\532-5606

Degree: PhD
Specialty: Industrial Engineering
Assigned: Materials Laboratory

Phanindramohan Das
Professor
Texas A&M University
Dept. of Meteorology
College Station, TX 77843
409\845-0633

Degree: PhD
Specialty: Geophysical Science
Assigned: Geophysics Laboratory

Vito DelVecchio
Chairman
Scranton, University of
Biology Dept.
Scranton, PA 18510
717\961-6117

Degree: PhD
Specialty: Biochemical Engineering
Assigned: School of Aerospace Medicine

Avery Demond
Assistant Prof.
Massachusetts, University of
Dept. of Civil Eng.
Amherst, MA 01003
413\545-0685

Degree: PhD
Specialty: Civil Engineering
Assigned: Engineering & Services Center

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

Walter Drost-Hansen
Professor
Miami, University of
Dept. of Chemistry
Coral Gables, FL 33124
305\284-5842

Degree: PhD
Specialty: Physical Chemical
Assigned: Wilford Hall Medical Center

Thomas Dwyer
Professor
Illinois, University of
104 South Mathews Ave.
Urbana, IL 61801
217\244-0720

Degree: PhD
Specialty: Mathematics
Assigned: Weapons Laboratory

Wayne Eckerle
Associate Prof.
Clarkson University
MIE Dept.
Clarkson University, NY 13676
315\268-2203

Degree: PhD
Specialty: Fluid Mechanics
Assigned: Aero Propulsion Laboratory

Dennis Farrell
Associate Prof
Cincinnati, University of
Mail Location 103
Cincinnati, OH 45210
513\556-6558

Degree: MS
Specialty: Electrical Engineering
Assigned: Flight Dynamics Laboratory

William Filippone
Associate Prof.
Arizona, University of
Group X6, MS B226
Los Alamos, NM 87545
505\665-2307

Degree: PhD
Specialty: Nuclear Engineering
Assigned: Weapons Laboratory

John Francis
Professor
Oklahoma, University of
865 Asp, Room 210
Norman, OK 73019
405\325-5011

Degree: PhD
Specialty: Mechanical Engineering
Assigned: Arnold Engineering Development Ctr.

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

Frank Gerner
Assistant Prof.
Cincinnati, University of
756 Baldwin Hall Mail Loc. #72
Cincinnati, OH 45221
513\566-2646

Degree: PhD
Specialty: Mechanical Engineering
Assigned: Aero Propulsion Laboratory

Robert Granger
Professor
US Naval Academy
Dept. of Mechanical Engineering
Annapolis, MD 21402
301\267-3186

Degree: PhD
Specialty: Mechanical Engineering
Assigned: Frank J. Seiler Research Lab.

William Grissom
Assistant Prof.
Morehouse College
830 Westview Dr. SW
Atlanta, GA 30314
404\681-2800

Degree: MS
Specialty: Mechanical Eng.
Assigned: Weapons Laboratory

Ian Grosse
Assistant Prof.
Massachusetts, University of
ELAB 213
Amherst, MA 01003
413\545-1350

Degree: PhD
Specialty: Mechanical Eng.
Assigned: Rome Air Development Center

John Hadjilogiou
Professor
Florida Instit.Tech.
150 West University Blvd.
Melbourne, FL 32901
407\768-8000

Degree: PhD
Specialty: Electrical Eng.
Assigned: Rome Air Development Center

Ernest Hallford
Assistant Prof.
Moorhead State Univ.
Dept. of Psychology
Moorhead, MN 56560
218\236-4077

Degree: PhD
Specialty: Psychology
Assigned: Aerospace Medical Research Lab.

60

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

Orlando Hankins
Assistant Prof.
North Carolina State Univ.
NCSU Box 7909
Raleigh, NC 27695
919\737-3292

Degree: PhD
Specialty: Nuclear Eng.
Assigned: Arnold Engineering Development Center

Patrick Hannon
Associate Prof.
Northern Arizona University
Box 6012
Flagstaff, AZ 86011
602\523-4331

Degree: PhD
Specialty: Exercise Science
Assigned: School of Aerospace Medicine

Cynthia Hardy
Associate Prof.
Jackson State Univ.
1400 Lynch St.
Jackson, MS 39217
601\968-2371

Degree: PhD
Specialty: Education Psychology
Assigned: School of Aerospace Medicine

Kirk Hatfield
Assistant Prof.
Florida, University of
346 Weil Hall
Gainesville, FL 32611
904\392-0956

Degree: PhD
Specialty: Civil Engineering
Assigned: Engineering & Services Center

Kim Hayes
Assistant Prof.
Michigan, University of
Dept. of Civil Engineering
Ann Arbor, MI 48109
313\763-9661

Degree: PhD
Specialty: Environmental Eng.
Assigned: Engineering & Services Center

Henry Helmken
Professor
Florida Atlantic University
PO Box 3091
Boca Raton, FL 33431
407\367-3452

Degree: PhD
Specialty: Physics
Assigned: Rome Air Development Center

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

Peter Henriksen
Associate Prof.
Akron, University
Dept. of Physics
Akron, OH 44325
216\375-6054

Degree: PhD
Specialty: Physics
Assigned: Materials Laboratory

Lloyd Hillman
Assistant Prof.
Cornell University
215 Phillips Hall
Ithaca, NY 14853
607\255-8212

Degree: PhD
Specialty: Optical Engineering
Assigned: Frank J. Seiler Research Lab.

Jeffrey Himm
Assistant Prof.
North Dakota State University
Dept. of Physics
Fargo, ND 58105
701\237-7048

Degree: PhD
Specialty: Physics
Assigned: School of Aerospace Medicine

Stuart Hirshfield
Associate Prof.
Hamilton College
Dept. of Math. & Comp. Sci.
Clinton, NY 13323
315\859-4136

Degree: PhD
Specialty: Computer Science
Assigned: Rome Air Development Center

Harry Hogan
Assistant Prof.
Texas A&M University
Eng./Physics Bldg.
College Station, TX 77843
409\845-1538

Degree: PhD
Specialty: Mechanical Eng.
Assigned: Weapons Laboratory

Gwendolyn Howze
Associate Prof.
Texas Southern Univ.
3100 Cleburne
Houston, TX 77004
713\527-7095

Degree: PhD
Specialty: Molecular Biology
Assigned: School of Aerospace Medicine

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

Carl Ingling
Associate Prof.
Ohio State Univ.
1314 Kinnear Rd.
Columbus, OH 43212
614\292-6424

Degree: PhD
Specialty: Psychology
Assigned: Aerospace Medical Research Lab.

Alan Kafka
Associate Prof.
Boston College
Weston Observatory
Weston, MA 02193
617\899-0950

Degree: PhD
Specialty: Geophysics
Assigned: Geophysics Laboratory

Mohammad Karim
Associate Prof.
Dayton, University of
300 College Park
Dayton, OH 45469
513\229-3611

Degree: PhD
Specialty: Electrical Eng.
Assigned: Avionics Laboratory

John Kenney
Assistant Prof.
Eastern New Mexico University
Station #33
Portales, NM 88130
505\562-2152

Degree: PhD
Specialty: Physical Chemistry
Assigned: Astronautics Laboratory

M. Kenney
Instructor
Eastern New Mexico University
Station #33
Portales, NM 88130
505\562-2152

Degree: MS
Specialty: Physical Chemistry
Assigned: Astronautics Laboratory

Charles Kincaid
Lecturer
Florida, University of
477 Little Hall
Gainesville, FL 32611
904\392-1941

Degree: MS
Specialty: Statistics
Assigned: Aerospace Medical Research Lab.

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

Lynn Kirms
Assistant Prof.
Southern Oregon St. College
Chemistry Dept.
Ashland, OR 97520
503\482-6471

Degree: PhD
Specialty: Organic Chemistry
Assigned: Astronautics Laboratory

Mark Kirms
Assistant Prof.
Southern Oregon St. College
Dept. of Chemistry
Ashland, OR 97520
503\482-6471

Degree: PhD
Specialty: Organic Chemistry
Assigned: Astronautics Laboratory

Michael Klein
Professor
Worcester Poly Inst
100 Institute Rd.
Worcester, MA 01609
508\831-5527

Degree: PhD
Specialty: Physics
Assigned: Rome Air Development Center

Faysal Kolkailah
Professor
California Polytec.
Dept. of Aero. Eng.
San Luis Obispo, CA 93407
805\786-2393

Degree: PhD
Specialty: Mechanical Eng.
Assigned: Astronautics Laboratory

William Kuriger
Professor
Oklahoma, University of
EECS Dept.
Norman, OK 73019
405\325-4721

Degree: PhD
Specialty: Electrical Eng.
Assigned: Rome Air Development Center

Thomas Lalk
Associate Prof.
Texas A&M Univ.
Dept. of Mechanical Eng.
College Station, TX 77843
409\845-4734

Degree: PhD
Specialty: Mechanical Eng.
Assigned: Aero Propulsion Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

John Lanning
Associate Prof.
Colorado-Denver, University
Box 144, 1200 Larimer St.
Denver, CO 80204
303\556-2557

Degree: PhD
Specialty: Analytical Chemistry
Assigned: Frank J. Seiler Research Lab.

Jay Lee
Assistant Prof.
Syracuse University
Link Hall
Syracuse, NY 13244
315\443-4395

Degree: PhD
Specialty: Electrical Engineering
Assigned: Rome Air Development Center

Lang-Wah Lee
Professor
Wisconsin-Plattevil.
Dept. of Mechanical Eng.
Platteville, WI 53818
608\342-1534

Degree: PhD
Specialty: Mechanical Eng.
Assigned: Arnold Engineering Development Center

Tze San Lee
Assistant Prof.
Western Illinois University
Dept. of Mathematics
Macomb, IL 61455
309\298-1485

Degree: PhD
Specialty: Applied Mathematics
Assigned: School of Aerospace Medicine

Baruch Lieber
Assistant Prof.
New York, State Univ. of
Dept. of Mech. & Aero. Eng.
Buffalo, NY 14260
716\636-2391

Degree: PhD
Specialty: Aerospace Engineering
Assigned: Aero Propulsion Laboratory

Charles Lishawa
Assistant Prof.
Utica College
Burstone Rd.
Utica, NY 13502
315\792-3139

Degree: PhD
Specialty: Physical Chemistry
Assigned: Geophysics Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

Dar-Biau Liu
Professor
California State University
Dept. of Comp. Sci. and Eng.
Long Beach, CA 90840
213\985-1594

Degree: PhD
Specialty: Applied Math
Assigned: Avionics Laboratory

Thomas Lockwood
Associate Prof.
Wright State Univ.
3640 Col. Glenn Hwy.
Dayton, OH 45435
513\873-3060

Degree: PhD
Specialty: Toxicology
Assigned: Aerospace Medical Research Lab.

Harold Longbotham
Assistant Prof.
Texas-San Antonio, University
7000 Loop 1604 NW
San Antonio, TX 78285
512\691-5518

Degree: PhD
Specialty: Electrical Eng.
Assigned: School of Aerospace Medicine

Lewis Lutton
Associate Prof.
Mercyhurst College
Glenwood Hills
Erie, PA 16546
814\825-0372

Degree: PhD
Specialty: Envir. Physiology
Assigned: Aerospace Medical Research Lab.

Ethel Matin
Professor
Long Island Univ.
CW Post Campus/LIU
Brookville, NY 11548
516\299-2063

Degree: PhD
Specialty: Exper. Psychology
Assigned: Aerospace Medical Research Lab.

Stewart Maurer
Associate Prof.
New York Inst. Tech.
1855 Bway
New York, NY 10023
212\399-9698

Degree: PhD
Specialty: Electrical Eng.
Assigned: Occupational and Environmental
Health Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED	
Amy Miller Assistant Prof. Oklahoma, Univ. of 620 Parrington Oval Norman, OK 73019 405\325-4836	Degree: Specialty: Assigned:	PhD Chemistry Geophysics Laboratory
Thomas Miller Professor Oklahoma, Univ. of Dept. of Physics & Astronomy Norman, OK 73019 405\325-3961	Degree: Specialty: Assigned:	PhD Physics Geophysics Laboratory
Deborah Mitta Assistant Prof. Texas A&M Univ. Dept. of Industrial Eng. College Station, TX 77843 409\845-3299	Degree: Specialty: Assigned:	PhD Industrial Eng. Human Resources Laboratory: Logistics & Human Factors
Augustus Morris Assistant Prof. Central State Univ. Dept. of Manufacturing Eng. Wilberforce, OH 45384 513\376-6435	Degree: Specialty: Assigned:	PhD Biomedical Engineering Flight Dynamics Laboratory
Rex Moyer Professor Trinity Univ. 715 Stadium Dr. San Antonio, TX 78284 512\736-7242	Degree: Specialty: Assigned:	PhD Microbiology School of Aerospace Medicine
Sundaram Natarajan Associate Prof. Tennessee Tech Univ. Box 5004 Cookeville, TN 38505 615\372-3450	Degree: Specialty: Assigned:	PhD Electrical Eng. Electronic Systems Division

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

Henry Nebel
Associate Prof.
Alfred University
Physics Dept.
Alfred, NY 14802
607\871-2208

<u>Degree:</u>   PhD
<u>Specialty:</u>   Physics
<u>Assigned:</u>   Geophysics Laboratory

Joseph Newkirk
Assistant Prof.
Missouri-Rolla, University
282 McNutt Hall
Rolla, MO 65401
314\341-4725

<u>Degree:</u>   PhD
<u>Specialty:</u>   Materials Science
<u>Assigned:</u>   Materials Laboratory

Duc Nguyen
Assistant Prof.
Old Dominion Univ.
Civil Eng. Dept.
Norfolk, VA 23529
804\683-3761

<u>Degree:</u>   PhD
<u>Specialty:</u>   Civil Engineering
<u>Assigned:</u>   Weapons Laboratory

James Noyes
Associate Prof.
Wittenberg Univ.
Box 720
Springfield, OH 45501
513\327-7858

<u>Degree:</u>   PhD
<u>Specialty:</u>   Computer Science
<u>Assigned:</u>   Avionics Laboratory

Hugh Nutley
Professor
Seattle Pacific University
3307 3rd Ave. W.
Seattle, WA 98119
206\281-2954

<u>Degree:</u>   PhD
<u>Specialty:</u>   Physics
<u>Assigned:</u>   Geophysics Laboratory

Robert O'Connell
Associate Prof.
Missouri, Univ. of
ECE Dept.
Columbia, MO 65211
314\882-8373

<u>Degree:</u>   PhD
<u>Specialty:</u>   Electrical Eng.
<u>Assigned:</u>   Rome Air Development Center

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

Bipin Pai
Associate Prof.
Purdue Univ.
Dept. of Eng.
Hammond, IN 46323
219\989-2694

Degree: PhD
Specialty: Mechanical Eng.
Assigned: Astronautics Laboratory

Harvey Paige
Associate Prof.
Alfred University
PO Box 546
Alfred, NY 14802
607\871-2201

Degree: PhD
Specialty: Inorganic Chem.
Assigned: Materials Laboratory

Arnold Polak
Professor
Cincinnati, University of
M.L. #70
Cincinnati, OH 45221
513\556-3550

Degree: PhD
Specialty: Aerospace Eng.
Assigned: Flight Dynamics Laboratory

Randy Pollack
Assistant Prof.
Wright State Univ.
Computer Sci. Dept.
Dayton, OH 45435
513\873-2491

Degree: PhD
Specialty: Anthropology
Assigned: Aerospace Medical Research Lab.

Raymond Quock
Professor
Univ. of Illinois at Rockford
604 N. 16th St.
Milwaukee, WI 53233
414\224-7251

Degree: PhD
Specialty: Pharmacology
Assigned: School of Aerospace Medicine

Vittal Rao
Professor
Missouri-Rolla, University
Dept. of Electrical Eng.
Rolla, MO 65401
314\341-4508

Degree: PhD
Specialty: Control Systems
Assigned: Astronautics Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED		

Craig Rasmussen
Assistant Prof.
Utah State Univ.
CASS UMC 4405
Logan, UT 84322
801\750-2967

Degree: PhD
Specialty: Physics
Assigned: Geophysics Laboratory

Michael Resch
Assistant Prof.
Nebraska-Lincoln, University of
212 Bancroft Hall
Lincoln, NE 68588
402\472-2354

Degree: PhD
Specialty: Materials Science
Assigned: Materials Laboratory

Richard Robertson
Professor
California State Univ.
3801 W. Temple Ave.
Pomona, CA 91768
714\869-3488

Degree: MS
Specialty: Mathematics
Assigned: Astronautics Laboratory

Larry Roe
Assistant Prof.
Virginia Poly Institute
Dept. of Mech. Eng.
Blacksburg, VA 24061
703\231-7295

Degree: PhD
Specialty: Mechanical Eng.
Assigned: Aero Propulsion Laboratory

Deborah Ross
Assistant Prof.
Indiana-Purdue, University of
2101 Coliseum Blvd. East
Fort Wayne, IN 46805
219\481-6313

Degree: PhD
Specialty: Microbiology
Assigned: Engineering & Services Center

Duane Sanders
Assistant Prof
Texas A&M Univ.
Dept. of Civil Eng.
College Station, TX 77843
409\845-9566

Degree: PhD
Specialty: Civil Engineering
Assigned: Weapons Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

John Sanders
Assistant Prof.
Northwestern State University
Fournet Hall
Natchitoches, LA 71497
318\357-5501

Degree: PhD
Specialty: Chemistry
Assigned: Frank J. Seiler Research Lab.

Paul Scheie
Professor
Texas Lutheran Coll
1000 West Court
Seguin, TX 78155
512\379-4161

Degree: PhD
Specialty: Biophysics
Assigned: School of Aerospace Medicine

William Schulz
Professor
Eastern Kentucky University
Moore 337
Richmond, KY 40475
606\622-1463

Degree: PhD
Specialty: Analytical Chemistry
Assigned: Aero Propulsion Laboratory

Ronald Seaman
Associate Prof.
Louisiana Tech University
PO Box 3185
Ruston, LA 71272
318\257-4562

Degree: PhD
Specialty: Biomedical Eng.
Assigned: School of Aerospace Medicine

Sally Sedelow
Professor
Arkansas-Little Rock, Univ.
33rd and University
Little Rock, AR 72204
501\569-8130

Degree: PhD
Specialty: Computer Science
Assigned: Rome Air Development Center

Nisar Shaikh
Assistant Prof.
Nebraska-Lincoln, University
212 Bancroft Hall
Lincoln, NE 68588
402\472-6692

Degree: PhD
Specialty: Applied Math.
Assigned: Flight Dynamics Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

Clay Sharts
Professor
San Diego State University
Dept. of Chemistry
San Diego, CA 92182
619\594-5576

Degree: PhD
Specialty: Chemistry
Assigned: Frank J. Seiler Research Lab.

Edmund Shearer
Professor
Fort Hays State University
600 Park St.
Hays, KS 67601
913\628-4506

Degree: PhD
Specialty: Chemistry
Assigned: Occupational and Environmental
Health Laboratory

James Sherwood
Assistant Prof.
New Hampshire, University of
Kingsbury Hall
Durham, NH 03824
603\862-2624

Degree: PhD
Specialty: Aero. Mechanics
Assigned: Materials Laboratory

Robert Shock
Associate
Wright State Univ.
Dept. of CEG and CS
Dayton, OH 45435
513\259-8402

Degree: PhD
Specialty: Mathematics
Assigned: Avionics Laboratory

Hugh Siefken
Chairman
Greenville College
Dept. of Physics
Greenville, IL 62246
618\664-4081

Degree: PhD
Specialty: Nuclear Physics
Assigned: Weapons Laboratory

John Silvestro
Assistant Prof.
Clemson Univ.
Riggs Hall
Clemson, SC 29634
803\656-5921

Degree: PhD
Specialty: Electrical Eng.
Assigned: Weapons Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED	
Miles Simpson Associate Prof. North Carolina Cent. Univ. Dept. of Sociology Durham, NC 27707 919\560-6420	Degree: Specialty: Assigned:	PhD Sociology Human Resources Laboratory: Manpower and Personnel Division
Boghos Sivazlian Professor Florida, Univ. of 303 Weil Hall Gainesville, FL 32611 904\392-1464	Degree: Specialty: Assigned:	PhD Operations Research Armament Laboratory
William Smith Associate Prof. Pittsburgh, Univ. of 526 C.L. Pittsburgh, PA 15260 412\624-6559	Degree: Specialty: Assigned:	PhD Linguistics Human Resources Laboratory: Training Systems
Michael Stanisic Assistant Prof. Notre Dame, University of Dept. of Aero/Mech Eng. Notre Dame, IN 46556 219\239-7897	Degree: Specialty: Assigned:	PhD Robotics Aerospace Medical Research Lab.
Stanley Stephenson Associate Prof. Southwest Texas State University CIS/ADS Dept. San Marcos, TX 78666 512\245-2291	Degree: Specialty: Assigned:	PhD Psychology Human Resources Laboratory: Training Systems
Chun Fu Su Assistant Prof. Mississippi State University Dept. of Physics Mississippi State, MS 39762 601\325-2931	Degree: Specialty: Assigned:	PhD Physics Arnold Engineering Development Center

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

Khaja Subhani
Associate Prof.
Lawrence Tech. Univ.
21000 West Ten Mile
Southfield, MI 48075
313\356-0200

Degree: PhD
Specialty: Electrical Eng.
Assigned: Rome Air Development Center

Larry Swanson
Assistant Prof.
Denver, Univ. of
2390 S. York St.
Denver, CO 80208
303\871-3816

Degree: PhD
Specialty: Mechanical Eng.
Assigned: Astronautics Laboratory

Michael Sydor
Professor
Minnesota-Duluth, University of
Dept. of Physics
Duluth, MN 55812
218\726-7205

Degree: PhD
Specialty: Physics
Assigned: Materials Laboratory

Joseph Szucs
Associate Prof.
Texas A&M Univ.
GACD PO Box 1675
Galveston, TX 77553
409\740-4463

Degree: PhD
Specialty: Functional Analytics
Assigned: Aerospace Medical Research Lab.

Chi-Ming Tang
Associate Prof.
New York, State Univ. of
Dept. of Math
Geneseo, NY 14454
716\245-5386

Degree: PhD
Specialty: Mathematics
Assigned: Aerospace Medical Research Lab.

Richard Tankin
Professor
Northwestern Univ.
Mechanical Eng. Dept.
Evanston, IL 60201
312\491-3532

Degree: PhD
Specialty: Mechanical Eng.
Assigned: Aero Propulsion Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

Teresa Taylor
Assistant Prof.
Missouri-Columbia, University of
600 West Mechanic
Independence, MO 64050
816\276-1285

Degree: PhD
Specialty: Civil Eng.
Assigned: Engineering & Services Center

Ebo Tei
Professor
Arkansas-Pine Bluff, Univ. of
Social & Behavioral Sci.
Pine Bluff, AR 71601
501\541-6787

Degree: PhD
Specialty: Psychology
Assigned: Aerospace Medical Research Lab.

Roger Thompson
Assistant Prof.
Pennsylvania St. University
233 Hammond Bldg.
University Park, PA 16802
814\863-0968

Degree: PhD
Specialty: Eng. Mechanics
Assigned: Astronautics Laboratory

Richard Tipping
Professor
Alabama, University
Dept. of Physics
Tuscaloosa, AL 35487
205\348-3799

Degree: PhD
Specialty: Physics
Assigned: Arnold Engineering Development Ctr.

Phillip Tomporowski
Assistant Prof.
Alabama, University of
Box 870348
Tuscaloosa, AL 35487
205\348-1936

Degree: PhD
Specialty: Psychology
Assigned: Human Resources Laboratory:
Operations Training Division

Ram Tripathi
Professor
Texas-San Antonio, Univ. of
Dept. of Mathematics
San Antonio, TX 78285
512\691-5549

Degree: PhD
Specialty: Statistics
Assigned: School of Aerospace Medicine

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

Steven Trogdon
Associate Prof.
Minnesota-Duluth, University of
108 Heller Hall
Duluth, MN 55812
218\726-6173

Degree: PhD
Specialty: Mechanics
Assigned: Armament Laboratory

Timothy Troutt
Associate Prof.
Washington State University of
Mech. & Mat. Eng. Dept.
Pullman, WA 99164
509\335-4375

Degree: PhD
Specialty: Mechanical Eng.
Assigned: Frark J. Seiler Research Lab.

Donald Ucci
Associate Prof.
Illinois Inst.Tech.
3300 S. Federal St.
Chicago, IL 60616
312\567-3405

Degree: PhD
Specialty: Electrical Eng.
Assigned: Rome Air Development Center

George Veyera
Assistant Prof.
Rhode Island, University of
Dept. of Civil Eng.
Kingston, RI 02881
401\792-2692

Degree: PhD
Specialty: Civil Eng.
Assigned: Engineering & Services Center

Hung Vu
Assistant Prof.
California State University
Mech. Eng. Dept.
Long Beach, CA 90840
213\985-1524

Degree: PhD
Specialty: Applied Mechanics
Assigned: Frank J. Seiler Research Lab.

Bonnie Walker
Assistant Prof.
Central State Univ.
Psychology Dept.
Wilberforce, OH 45384
513\376-6516

Degree: PhD
Specialty: Experimental Psychology
Assigned: Aerospace Medical Research Lab.

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

William Wallace
Professor
Rensselaer Poly. Inst
CII Room 5117
Troy, NY 12180
518\276-6452

Degree: PhD
Specialty: Management Science
Assigned: Rome Air Development Center

Ji Wang
Professor
San Jose State Univ.
S. 7 St.
San Jose, CA 95192
408\924-4299

Degree: PhD
Specialty: Mechanical Eng.
Assigned: Astronautics Laboratory

Phillip Wapner
Associate Prof.
Southern Illinois University
Dept. of Mech. Eng.
Carbondale, IL 62901
618\453-7021

Degree: PhD
Specialty: Chemical Eng.
Assigned: Astronautics Laboratory

Robert Wheasler
Professor
Wyoming, Univ. of
Box 3295 University Station
Laramie, WY 82071
307\766-5126

Degree: PhD
Specialty: Engineering
Assigned: Aero Propulsion Laboratory

D. Wilkes
Assistant Prof.
Vanderbilt Univ.
Box 1649 Station B
Nashville, TN 37235
615\343-6016

Degree: PhD
Specialty: Electrical Eng.
Assigned: Arnold Engineering Development
Center

Robert Willis
Associate Prof.
Mercer University
1400 Coleman Ave.
Macon, GA 31207
912\744-2704

Degree: PhD
Specialty: Physics
Assigned: Geophysics Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

John Wills
Professor
Indiana Univ.
Physics Dept.
Bloomington, IN 47405
812\855-1479

Degree: PhD
Specialty: Physics
Assigned: Geophysics Laboratory

David Woehr
Assistant Prof.
Texas A&M Univ.
Dept. of Psychology
College Station, TX 77843
409\845-2097

Degree: PhD
Specialty: Industrial Psychology
Assigned: Human Resources Laboratory:
Manpower and Personnel Division

Michael Wolfe
Assistant Prof.
West Virginia Univ.
PO Box 6025
Morgantown, WV 26506
304\293-4495

Degree: PhD
Specialty: Management Science
Assigned: Human Resources Laboratory:
Logistics & Human Factors

William Wolfe
Associate Prof.
Ohio State Univ.
470 Hitchcock Hall
Columbus, OH 43210
614\292-0790

Degree: PhD
Specialty: Engineering
Assigned: Flight Dynamics Laboratory

James Wolper
Assistant Prof.
Hamilton College
Dept. of Math. & Comp. Sci.
Clinton, NY 13323
315\859-4417

Degree: PhD
Specialty: Mathematics
Assigned: Rome Air Development Center

Asad Yousuf
Assistant Prof.
Savannah State College
PO Box 20089
Savannah, GA 31404
912\356-2154

Degree: MS
Specialty: Electrical Eng.
Assigned: Armament Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED

Juin Yu
Professor
West Virginia Tech.
Mechanical Eng. Dept.
Montgomery, WV 25136
304\442-3248

Degree: PhD
Specialty: Mechanical Engineering
Assigned: Flight Dynamics Laboratory

Gregory Zagursky
Assistant Prof.
Morris College
Div. General Studies
Sumter, SC 29150
803\775-9371

Degree: MS
Specialty: Biology
Assigned: Occupational and Environmental
Health Laboratory

Lawrence Zavodney
Assistant Prof.
Ohio State Univ.
209 Boyd Lab.
Columbus, OH 43210
614\292-2209

Degree: PhD
Specialty: Mechanical Eng.
Assigned: Flight Dynamics Laboratory

Yehoshua Zeevi
Professor
Harvard Univ.
Applied Sciences
Cambridge, MA 02138
617\495-2850

Degree: PhD
Specialty: Electrical Eng.
Assigned: Human Resources Laboratory:
Operations Training Division

Robert Zerwekh
Assistant Prof.
Northern Illinois University
Dept. of Comp. Sci.
DeKalb, IL 60115
815\753-6949

Degree: PhD
Specialty: Philosophy
Assigned: Human Resources Laboratory:
Training Systems

Henry Zmuda
Assistant Prof.
Stevens Inst Tech
Dept. of Electrical Eng.
Hoboken, NJ 07030
201\420-5507

Degree: PhD
Specialty: Electrical Eng.
Assigned: Rome Air Development Center

APPENDIX II C

PARTICIPANT LABORATORY ASSIGNMENT

1989 USAF/UES SUMMER FACULTY RESEARCH PROGRAM

AERO PROPULSION LABORATORY (WRDC/AFL)
(Wright-Patterson Air Force Base)

1.	Mingking Chyu	6.	Baruch Lieber
2.	Jerry Clark	7.	Larry Roe
3.	Wayne Eckerle	8.	William Schulz
4.	Frank Gerner	9.	Richard Tankin
5.	Thomas Lalk	10.	Robert Wheasler

ARMAMENT LABORATORY (ATL)
(Eglin Air Force Base)

1.	Peter Armandarez	6.	George Coleman
2.	Joseph Brown	7.	Boghos Sivazlian
3.	Roger Bunting	8.	Steven Trogdon
4.	Satish Chandra	9.	Asad Yousuf
5.	David Cicci		

HARRY G. ARMSTRONG AEROSPACE MEDICAL RESEARCH LABORATORY (AAMRL)
(Wright-Patterson AFB)

1.	Ernest Hallford	7.	Randy Pollack
2.	Carl Ingling	8.	Michael Stanisic
3.	Charles Kincaid	9.	Joseph Szucs
4.	Thomas Lockwood	10.	Chi-Ming Tang
5.	Lewis Lutton	11.	Ebo Tei
6.	Ethel Matin	12.	Bonnie Walker

ARNOLD ENGINEERING DEVELOPMENT CENTER (AEDC)
(Arnold Air Force Base)

1.	Brian Beecken	6.	Orlando Hankins
2.	Lee Britt	7.	Lang-Wah Lee
3.	Brian Circelli	8.	Chun Fu Su
4.	Stephen Cobb	9.	Richard Tipping
5.	John Francis	10.	D. Mitchell Wilkes

ASTRONAUTICS LABORATORY (AL)
Edwards Air Force Base)

1.	John Kenney	7.	Vittal Rao
2.	M. Inga Kenney	8.	Richard Robertson
3.	Lynn Kirms	9.	Larry Swanson
4.	Mark Kirms	10.	Roger Thompson
5.	Faysal Kolkailah	11.	Ji Wang
6.	Bipin Pai	12.	Phillip Wapner

AVIONICS LABORATORY (WRDC/AL)
(Wright-Patterson Air Force Base)

1.	David Choate	5.	Dar-Biau Liu
2.	R. H. Cofer	6.	James Noyes
3.	Larry Crum	7.	Robert Shock
4.	Mohammad Karim		

C. PARTICIPANT LABORATORY ASSIGNMENT (Page 2)

ELECTRONIC SYSTEMS DIVISION (ESD)
(Hanscom Air Force Base)
1. Beryl Barber
2. Ajit Choudhury
3. S. Natarajan

ENGINEERING AND SERVICES CENTER (ESC)
(Tyndall Air Force Base)
1. Jon Anderson
2. William Bannister
3. Emerson Besch
4. Anthony Carlisle
5. Derald Chriss
6. Avery Demond
7. Kirk Hatfield
8. Kim Hayes
9. Deborah Ross
10. Teresa Taylor
11. George Veyera

FLIGHT DYNAMICS LABORATORY (WRDC/FDL)
(Wright-Patterson Air Force Base)
1. Larry Byrd
2. Kenneth Cornelius
3. Dennis Farrell
4. Augustus Morris
5. Arnold Polak
6. Nisar Shaikh
7. William Wolfe
8. Juin Yu
9. Lawrence Zavodney

FRANK J. SEILER RESEARCH LABORATORY (FJSRL)
(USAF Academy)
1. R. Granger
2. L. Hillman
3. John Lanning
4. John Sanders
5. Clay Sharts
6. Timothy Troutt
7. Hung Vu

GEOPHYSICS LABORATORY (AFGL)
(Hanscom Air Force Base)
1. Pradhip Bakshi
2. Chi Chen
3. P. Das
4. Alan Kafka
5. Charles L. Shaw
6. Amy Miller
7. Thomas Miller
8. Henry Nebel
9. Hugh Nutley
10. Craig Rasmussen
11. Robert Willis
12. John Wills

HUMAN RESOURCES LABORATORY (HRL)
(Brooks, Williams, and Wright-Patterson Air Force Bases)
1. Christopher Bell
2. Kevin Bennett
3. Kathryn Cochran
4. Deborah Mitta
5. Miles Simpson
6. William Smith
7. Stanley Stephensen
8. P. Tomporowski
9. David Woehr
10. Michael Wolfe
11. Yehoshua Zeevi
12. Robert Zerwekh

C. PARTICIPANT LABORATORY ASSIGNMENT (Page 3)

MATERIALS LABORATORY (ML)
(Wright-Patterson Air Force Base)
1. Karren Brito
2. Donald Chung
3. Kenneth Currie
4. Peter Henrisken
5. Joseph Newkirk
6. Harvey Paige
7. Michael Resch
8. James Sherwood
9. Michael Sydor

OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY (OEHL)
(Brooks Air Force Base)
1. Barbara Alvin
2. Stewart Maurer
3. Edmund Shearer
4. Gregory Zagursky

ROME AIR DEVELOPMENT CENTER (RADC)
(Griffiss Air Force Base)
1. Charles Alajajian
2. Ian Grosse
3. John Hadjilogiou
4. Henry Helmken
5. Stuart Hirshfield
6. Michael Klein
7. William Kuriger
8. Jay Lee
9. Robert O'Connell
10. Sally Sedelow
11. Khaja Subhani
12. Donald Ucci
13. William Wallace
14. James Wolper
15. Henry Zmuda

SCHOOL OF AEROSPACE MEDICINE (SAM)
(Brooks Air Force Base)
1. Thomas Abraham
2. Robert Blystone
3. Carolyn Caudle-Alexander
4. James Chambers
5. Mark Cornwall
6. Vito DelVecchio
7. Patrick Hannon
8. Cynthia Hardy
9. Jeffrey Himm
10. Gwendolyn Howze
11. Tze San Lee
12. Harold Longbotham
13. Rex Moyer
14. Raymond Quock
15. Paul Scheie
16. Ronald Seaman
17. Ram Tripathi

WEAPONS LABORATORY (WL)
(Kirtland Air Force Base)
1. Thomas Dwyer
2. William Filippone
3. William Grissom
4. Harry Hogan
5. Duc Nguyen
6. Duane Sanders
7. Hugh Siekfen
8. John Silvestro

WILFORD HALL MEDICAL CENTER (WHMC)
(Lackland Air Force Base)
1. Walter Drost-Hansen

APPENDIX III

A. Listing of Research Reports Submitted in the
   1989 Summer Faculty Research Program

B. Abstracts of the 1989 Summer Fellow's
   Research Reports

RESEARCH REPORTS

APPENDIX III A

RESEARCH REPORTS

1989 SUMMER FACULTY RESEARCH PROGRAM

Technical Report Number	Title	Professor
Volume I		
Armament Laboratory		
1	Reactive Compositions Using Light Metals and Metal Alloys	Dr. Peter Armendarez
2	Maneuvering Hard Target Penetrators	Dr. Joseph Brown
3	A Study of Ionic Polymer Membranes for Application as Capacitor Electrolytes and Preliminary Investigations on Photo-Activated Stripline Switches	Dr. Roger Bunting
4	Multisensor Seeker for Medium Range Air-to-Air Missiles	Dr. Satish Chandra
5	Extended Kalman Filter Tuning and Alternative Techniques	Dr. David Cicci
6	Statistical Analysis of Blast Loading in Concrete	Dr. George Coleman
7	A Methodology for Evaluating the Effectiveness of Smart Submunition Systems	Dr. Boghos Sivazlian
8	Shock Wave Initiated Detonation of an Explosive	Dr. Steven Trogdon
9	Distributed Filter Architecture Implementation with VLSI and Expert Systems	Dr. Asad Yousuf
Arnold Engineering Development Center		
10	Response of Infrared Detectors to Pulsed Radiation	Dr. Brian Beecken
11	An Analysis of Focal Plane Irradiance Effects on IR Detectors	Dr. Lee Britt
12	Code Development for Design of a High Temperature Hypersonic Facility Mixer	Dr. Brian Circelli

Arnold Engineering Development Center (continued)

13	Laser-Induced Fluorescence of Iodine and Sodium for Application in Resonant Doppler Velocimetry of Hypersonic Flows	Dr. Stephen Cobb
14	Thermal Analysis of Bodies Subjected to Aerodynamic Heating	Dr. John Francis
15	Diagnostics for Determination of Arc Plasma Parameters of the AEDC HEAT H1 Arc Heater	Dr. Orlando Hankins
16	The Design of Jet Mixers for an Arc Heater: An Experimental Approach	Dr. Lang-Wah Lee
17	Laser Induced Fluorescence (LIF) of Nitric Oxide (NO)	Dr. Chun Fu Su
18	Spectroscopic Monitoring of Exhaust Gases	Dr. Richard Tipping
19	Distributed and Parallel Image and Signal Processing	Dr. D. Wilkes

Astronautics Laboratory

20	Magnetic Perturbations of the Structural Characteristics, Photophysical Properties and Photochemical Behavior of Cryogenic Noble Gas-Alkali Metal Matrices	Dr. John W. Kenney
21	I_{sp} Enhancement Via Adsorption/ Absorption of Small Energetic Molecules on Solid Propellants	Dr. M. Inga Kenney
22	Studies Toward the Synthesis of Pentanitrobishomocubane	Dr. Lynn M. Kirms
23	The Preparation of Poly(imide Siloxane) Polymers: Oxygen Resistant Space Polymers	Prof. Mark Kirms
24	Numerical Presentation of Stress Analysis, Design and Fracture Mechanics for Composite Materials and Structures	Dr. Faysal Kolkailah
25	Fracture Behavior of a Composite Solid Rocket Propellant	Dr. Bipin Pai
26	Robust Control of a L Experimental Grid Using Reduced Order Models	Dr. Vittal Rao

Astronautics Laboratory (continued)

27   A Neural Network Approach to the Adaptive Control of Large Space Structures   Dr. Richard Robertson

28   Cryogenic Heat Pipes   Dr. Larry Swanson

29   Design and Development of a Flexible Multi-Body Dynamics Experiment   Dr. Roger Thompson

30   Synthesis of Active Space Structure Vibration Control Systems for an Astrex Test Article   Dr. Ji Wang

31   Dynamic Mechanical Response of Carbon/Carbon Composites by Vibrating Reed Measurements   Dr. Phillip Wapner

Electronics Systems Division

32   Carrier Free Radar   Dr. Beryl Barber

33   Detection Performance for Over Resolved Targets with Varying Energy Level in Cells   Dr. Ajit Choudhury

34   Analysis of Testability Concepts and its Application to RSIP   Dr. S. Natarajan

Engineering and Services Center

35   Proposed Innovative Semi-Hard Aircraft Shelter   Dr. Jon Anderson

36   JP-8 Ignitability   Dr. William Bannister

37   Effect of Jet Aircraft Noise on Domestic Goats   Dr. Emerson Besch

38   An Algorithmic System for Subjective Comparisons   Dr. Anthony Carlisle

39   The Study of Alkali-Enhanced Cements and Concretes   Dr. Derald Chriss

40   Prediction of the Capillary Pressure-Saturation Relationships for Aquifers Contaminated with Jet Fuels   Dr. Avery Demond

41   Contaminant Flux Reduction Through In Situ Solubility Modification   Dr. Kirk Hatfield

Engineering and Services Center (continued)

Volume II
Frank J. Seiler Research Laboratory

Geophysics Laboratory

Geophysics Laboratory (continued)

56   Estimating Characteristics of Chemical   Dr. Alan Kafka
Explosions in New England and Eastern
Kazakhstan Using Local and Regional
Seismic Data

57   A Study of the Water Vapor Cation-   Dr. Randal Lishawa
Neutral Reactions

58   Acidities of Iron Hydride and Various   Dr. Amy Miller
Transition-Metal Compounds; Reactions
of Iron and Iron Carbonyl Anions

59   Acidities of Iron Hydride and Various   Dr. Thomas Miller
Transition-Metal Compounds; Reactions
of Iron and Iron Carbonyl Anions
(Same Report as Dr. Amy Miller)

60      $CO_2(4.3\mu m)$ Vibrational Temperatures and   Dr. Henry Nebel
Limb Radiances Under Sunlit Conditions
in the 50-120 KM Altitude Range

61   Estimating Solar Flare Proton Fluences   Dr. Hugh Nutley
From 1850 with Tritium Data

62   Electric Fields in the Middle-and Low-   Dr. Craig Rasmussen
Latitude Ionosphere and Plasmasphere

63   Review and Assessment of Carbon Dioxide   Dr. Robert Willis
Pressure Broadening Data

64   Non-Uniform Clouds   Dr. John Wills

Rome Air Development Center

65   Design Considerations in the   Dr. Charles Alajajian
Implementation of ACT Programmable
Transversal Filters

66   Automating Finite Element Reliability   Dr. Ian Grosse
Assessment of Microelectronic Components

67   Design for Testability: From   Dr. John Hadjilogiou
Components to Systems

68   Development of a High Resolution   Dr. Henry Helmken
Research Facility

69   Iterative V&V: A Model for Verification   Dr. Stuart Hirshfield
and Validation in the Rapid Prototyping
Life Cycle

Rome Air Development Center (continued)

70	Capable Neural Networks for Applications in Data Analysis (1988 Participant)	Dr. Oleg Jakubowicz
71	A Study of Interacting Tunneling Units with Possible Application to High Temperature Superconductors	Dr. Michael Klein
72	Design of a Practical Binary Phase-Only Optical Correlator	Dr. William Kuriger
73	A Computer for Temporal Frequency Spectrum of Vegetation Clutter Return	Dr. Jay Lee
74	Material Effects in Photoconductive Frozen Wave Generators	Dr. Robert O'Connell
75	Parallel Processing for Associative Semantic Space Analysis	Dr. Sally Sedelow
76	Characterization of an Optical Switch	Dr. Khaja Subhani
77	Study of a Communication Receiver for Spread Spectrum Signals	Dr. Donald Ucci
78	Tactical Command and Control: A Group Problem Solving and Decision Making Process	Dr. William Wallace
79	Neural Networks for Invariant Pattern Recognition: A Survey of the State of the Art	Dr. James Wolper
80	Optical Beamforming for Phased Array Antennas	Dr. Henry Zmuda

Weapons Laboratory

81	An Experimental Protocol for Line-of-Sight Slewing, Optical Alignment and AFT Body Station Keeping Control Emulation	Dr. Thomas Dwyer
82	Linking the Twodant S_N Code and the MCNP Monte Carlo Code	Dr. William Filippone
83	Simulation of a Spray Reactor for Generating Excited Oxygen	Dr. William Grissom
84	Modeling the Response of Pressurized Composite Cylinders to Laser Damage	Dr. Harry Hogan

Weapons Laboratory (continued)

85   Parallel and Vector Processing for   Dr. Duc Nguyen
          Nonlinear Finite Element Analysis
          ** To be published at Weapons Lab
          as Technical Memorandum **

86   Scattering of Elastic Waves in a   Dr. Duane Sanders
          Random Inhomogeneous Soil Media

87   A Possible New Source of Negative   Dr. Hugh Siefken
          Hydrogen Ions

88   The Effect of a Maverick Missile on   Dr. John Silvestro
          a Test Antenna at Spacings Less
          than $2D^2/\lambda$

Volume III
(Wright Research Development Center)
Aero Propulsion Laboratory

89   Preliminary Report on Measurements of   Dr. Mingking Chyu
          Turbulent Transport in a Rib
          Roughened Channel

90   Experimental Study of Electronic   Dr. Jerry Clark
          Excitation of Xenon by Electron Impact

91   No Report Submitted   Dr. Wayne Eckerle

92   Flow Limitations in Micro Heat Pipes   Dr. Frank Gerner

93   Conceptual Design of an In-House   Dr. Thomas Lalk
          Facility for Endothermic Fuels Research
          (Report is not publishable at this time)

94   Large-Scale Motion and Coherent   Dr. Baruch Lieber
          Structures in Axisymmetric Swirling
          Flow of a Dump Combustor

95   Stability Modification and Flowfield   Dr. Larry Roe
          Evaluation of a Ramjet Combustor Model

96   Oxidative Thermal Degradation Studies   Dr. William Schulz
          of a Surrogate JP-8 with a Modified
          Thermal Precipitation Apparatus

97   Measurements of Droplet Velocity and   Dr. Richard Tankin
          Size Distributions in Sprays

98   Aircraft Engine Compressor and Fan   Dr. Robert Wheasler
          Rework Practices

Avionics Laboratory

99	A Theoretical Resolution of Multiple Frequencies	Dr. David Choate
100	Ladar Target Detection and Recognition	Dr. R. H. Cofer
101	Toolbox for Image Processing using Distributed Computing	Dr. Larry Crum
102	Analytical Model of a Unique E-O Beam Scanner	Dr. Mohammad Karim
103	Dynamic Task Scheduling for the "ADA Distributed System Evaluation Testbed (ADSET)"	Dr. Dar-Biau Liu
104	Ada Compiler Efficiency Evaluation	Dr. James Noyes
105	Towards a Course-Grained Test Suite for VHDL Validation	Dr. Robert Shock

Flight Dynamics Laboratory

106	Parametric Study of Combined Boiling and Partial Dryout in Liquid Metal Heat Pipe Wicks	Dr. Larry Byrd
107	3-D Analysis of Laser Measurements of Vortex Bursting on Chined Forebody Fighter Configuration	Dr. Kenneth Cornelius
108	Robust Design Using Internal Model Control	Dr. Dennis Farrell
109	Neural Networks and their Role in Visual Object Recognition	Dr. Augustus Morris
110	A Study of Surface Roughness Effects in Hypersonic Flow	Dr. Arnold Polak
111	Life Prediction of Aircraft Transparencies by Accelerated Crazing Tests	Dr. Nisar Shaikh
112	Strain Distribution in Composite Coupons in Tension	Dr. William Wolfe
113	Characteristics of an Osmotically Driven Thermal Transfer Cycle	Dr. Juin Yu
114	The Influence of Viscoelastically Damped Members on the Dynamic Response of Flexible Elastic Structures	Dr. Lawrence Zavodney

Materials Laboratory

115	No Report Submitted	Dr. Karren Brito
116	The in-situ Laser Deposition of Superconducting Thin Film	Dr. Donald Chung
117	An Intelligent Neural Model for Recognition of Input/Output Patterns for a Molecular Beam Epitaxy Process	Dr. Kenneth Currie
118	Scanning Tunneling Microscopy and Ballistic-Electron-Emission Spectroscopy	Dr. Peter Henriksen
119	Evaluation of CR-SI Alloys for Aerospace Structural Applications	Dr. Joseph Newkirk
120	Molecular Modeling and Computational Chemistry: Studies of Additives for Fluids and Lubricants	Dr. Harvey Paige
121	Improvement in the Detection of Microcrack Initiation and Growth During Fatigue Cycling by Surface Acoustic Wave Scattering	Dr. Michael Resch
122	Investigation of the Thermomechanical Response of a Titanium Aluminide Metal Matrix Composite Using a Viscoplastic Constitutive Theory	Dr. James Sherwood
123	Photoreflectance of AlGaAs/GaAs Interfaces	Dr. Michael Sydor

Volume IV
Human Systems Division Laboratories
Harry G. Armstrong Aerospace Medical Research Laboratory

124	Perceived Time to Contact as a Function of Event Structure During Self Motion	Dr. Ernest Hallford
125	The Effect of Luminance on the Perceived Saturation of Lights	Dr. Carl Ingling
126	Comparison of Microsaint and Colored Petri Nets as Modeling Techniques	Dr. Charles Kincaid
127	Degradation of the Renal Peritubular Basement Membrane in Relation to Toxic Nephropathy of Fuels of Military Interest	Dr. Thomas Lockwood

Harry G. Armstrong Medical Research Laboratory (continued)

128	Heart Rate and Other Cardiovascular Parameters as Measures of Mental Effort	Dr. Lewis Lutton
129	Breakdown of Total Information Processing Time into During-Display and Post-Display Components for Serial and Spatially Distributed Visual Presentations	Dr. Ethel Matin
130	An Investigation Into Techniques for Landmark Identification on 3-D Images of Human Subjects (Not publishable at this time)	Dr. Randy Pollack
131	Kinematic Mappings Between the EXOS Handmaster Exoskeleton[1] and the Utah/MIT Dexterous Robot Hand	Dr. Michael Stanisic
132	Harness Belt Task	Dr. Joseph Szucs
133	Articulated Total Body (ATB) View Program with Harness-Belt Implementation	Dr. Chi-Ming Tang
134	Insights into Human Factors in Aviation with Emphasis on Non-Canonical Flow Fields	Dr. Ebo Tei
135	Effects of Data Error on Problem-Solving Heuristics	Dr. Bonnie Walker

Human Resources Laboratory

136	Software Development to Support Data Collection and Analysis of Cognitive Task Analysis Studies	Dr. Christopher Bell
137	Computer-based Training for Complex, Dynamic Tasks	Dr. Kevin Bennett
138	Working Memory and Cognitive Structure	Dr. Kathryn Cochran
139	Investigation of Color Appearance within Low Light Levels (1988 Participant)	Dr. Douglas Mandra
140	Fisheye Representation of Information: IMIS User Interface	Dr. Deborah Mitta
141	The Validation of the Occupational Learning Difficulty (OLD) Index as a Predictor of Retrainee Performance	Dr. Miles Simpson

Human Resources Laboratory

142	Assessment of Intelligent Tutoring Systems	Dr. William Smith
143	The Role of the Instructor in Computer Based Training (CBT)	Dr. Stanley Stephenson
144	Evaluation of Air-Intercept Performance: Observer Reliability Issues	Dr. Phillip Tomporowski
145	Career Progression in Air Force Enlisted Personnel: An Examination of Two Alternate Criterion Measures	Dr. David Woehr
146	Development of the "City of Quality (Coq)" Group Decision Support System	Dr. Michael Wolfe
147	Variable Resolution Imagery for Flight Simulators	Dr. Yehoshua Zeevi
148	Neurocomputing the Student Model in an Intelligent Tutoring System	Dr. Robert Zerwekh

Occupational and Environmental Health Laboratory

149	Statistical Analyses of Data Pertaining to Ground Water Contamination and Laboratory Quality Control	Dr. Barbara Alvin
150	Design of an Automated Radiofrequency Radiation Measurement System (ARRMS)	Dr. Stewart Maurer
151	Construction and Use of an Identification Manual for Identifying Fibrous Material by Scanning Electron Microscopy with Attached X-Ray Analyzer	Dr. Edmund Shearer
152	Biological Analysis of Three Ponds at Peterson AFB, Colorado Springs, CO	Dr. Gregory Zagursky

School of Aerospace Medicine

153	Convergence Properties of the Occurrence/Exposure Rate	Mr. Thomas Abraham
154	Transmission Electron Microscopy of Mouse Macrophase RAW 264.7 Cells treated with Lipopolysaccharide, 3-Amino Tryosine, and RFR	Dr. Robert Blystone
155	Effects of Microwave Radiation on Cultured Cells	Dr. Carolyn Caudle-Alexander

156	The Effects of Three Reputed Carboxyesterase Inhibitors Upon Rat Serum Esterase Activity Using Paranitrophenyl and Naphthyl Esters as Substrates	Dr. James Chambers
157	Anti-G Suit Inflation Influence on Lower Extremity Muscle Performance during Sustained +G, Acceleration	Dr. Mark Cornwall
158	PCR Analysis and in situ Detection of Ureaplasma urealyticum and Mycoplasma hominis	Dr. Vito DelVecchio
159	The Influence of Broad Spectrum Illumination on Circadian Neuroendocrine Responses and Performance	Dr. Patrick Hannon
160	The relationship between locus of control, performance on cognitive tasks, and affective states after the consumption of antihistamines in hi- and low-workload conditions among aircrew personnel	Dr. Cynthia Ford Hardy
161	Aspects of the Diffusion of Inert Gases in Biological Systems	Dr. Jeffrey Himm
162	Studies of Interactions Between Microwaves, Melanin and Melanocytes	Dr. Gwendolyn Howze
163	Two-Phase Regression Model with Application	Dr. Tze-San Lee
164	System and Signal Analysis of VEP Data and Joystick Error Analysis	Dr. Harold Longbotham
165	Higher Plant Hormones Effect Upon Chlamydomonas Phototaxis	Dr. Rex Moyer
166	Influence of Radio Frequency Radiation on Psychotropic Drug Effects	Dr. Raymond Quock
167	Porous Glass as Bed Material in a Pressure Swing Adsorption Unit Used for Air Purification	Dr. Paul Scheie
168	Models for RFR Biological Effects	Dr. Ronald Seaman

School of Aerospace Medicine (continued)

169   An Investigation of Dioxin Half-Life   Dr. Ram Tripathi
Heterogeneity in Humans Based on Two
Measurements per Subject

Wilford Hall Medical Center

170   Temperature Effects on Erythrocyte   Dr. Walter Drost-Hansen
Sedimentation Rates in Whole Blood
and on Erythrocyte and Platelet
Volumes

APPENDIX III B

ABSTRACTS

ABSTRACTS
ARMAMENT LABORATORY

Reactive Compositions Using Light Metals and Metal Alloys

Peter Armandarez

ABSTRACT

The explosive nature of ammonium perchlorate is studied. Its use in high energy compositions involving light metals and their alloys is investigated. Thermodynamic calculations using the Tiger Code were carried out to predict the performance of several reactive compositions.

The use of metal alloying reactions to boost the output of reactive compositions is examined. A reactive warhead design is proposed using metal alloying systems.

Maneuvering Hard Target Penetrators

by
Joseph M. Brown

ABSTRACT

The hard target ordinance package (HTOP) is a 500-pound class
bomb designed to penetrate deeply into hardened surface emplacements.
When several HTOP's are deployed simultaneously it is possible to
target each one individually by incorporating propulsion and guidance
and, thereby, produce a large "footprint" on the earth. Rocket motors
were sized and flight performance studies were made to predict the foot
print size. Typically it was determined that for 50 pounds of
maneuver weight applied to a 339-pound bomb (i.e., for 15 percent
weight increase) launched at 2000 feet with an 800 fps velocity, a
dispersion radius of approximately 200 feet could be obtained. Weight
is not a critical limit but a 3-bomb deployment pod could require a 5
or 6 inch increase in diameter to accommodate the rocket nozzles.

Some peripheral investigations were made into target penetration
and into the utilization of propellants which would act as reactive
fragments.

A Study of Ionic Polymer Membranes for Application as Capacitor Electrolytes

and

Preliminary Investigations on Photo-activated Stripline Switches

by

Roger K. Bunting

ABSTRACT

A variety of polymeric materials and preparative procedures were investigated for electrolyte applications in high energy density capacitors. A low equivalent weight ionic polymer with high moisture content was found to give a capacitor with good voltage stability and remarkably high capacitance, but its performance was extremely temperature dependent.

Photoconducting polymers were shown to be viable materials for further development toward their application in photo-activated switching devices.

Multisensor Seeker for Medium Range

Air-to-Air Missiles

by

D.V. Satish Chandra

ABSTRACT

The principal technology issues identified, and techniques proposed include a cylindrically shaped, frequency scanned, conformal radio frequency (RF) antenna array and a gimbal designed heterodyne/direct double detector infrared (IR) sensor in an array configuration. Alternative design options for both RF and IR sensors are also suggested. A comprehensive summary of advantages and disadvantages for different types of sensors is also provided. Methods of integrating information from the sensors at both pixel-level and system-level to increase the performance of the missile seekers are briefly discussed.

EXTENDED KALMAN FILTER TUNING AND ALTERNATIVE TECHNIQUES

by

David A. Cicci

ABSTRACT

The guidance software for a Lightweight Exoatmospheric Projectile Simulation (LEAPSIM) was modified in order for the seeker to acquire the target earlier in the trajectory. This required the terminal guidance Extended Kalman Filter (EKF) to operate for a significantly longer period of time. The EKF (as developed) was diverging and providing poor estimates of predicted miss distances. This terminal guidance EKF was modified and "tuned" to provide the required predicted miss distances of less than one meter.

As an alternative to the process of tuning an EKF, a sequential estimator based upon the theory of ridge-type estimation was developed. This modified filter is adaptive and will not require tuning of the noise parameters to prevent divergence. This filter was tested in the terminal guidance phase of the LEAPSIM software.

STATISTICAL ANALYSIS OF BLAST LOADING IN CONCRETE

by

George W. Coleman Jr., M.S.

ABSTRACT

The collected test data of the experiment of explosive loads on concrete slabs in an enclosed blast chamber was provided. The collected test data was separated into classes and sorted in databases. Statistical analysis software was used to perform regression analysis on the data. The magnitude of loads on the side of the pressure vessel and on the top face of the concrete slabs at the bottom of the vessel were analyzed by performing a regression analysis.

<u>A Methodology for Evaluating the Effectiveness</u>

<u>of Smart Submunition Systems</u>

by

B. D. Sivazlian

ABSTRACT

A methodology is developed to assess the effectiveness of smart submunition systems. We provide a formal analysis of the aggregate problem and characterize the elements of the system. A mathematical model can be formulated which describes the temporal operation of the weapon system in a combat situation involving threats, countermeasures and uncertainty. A solution procedure is suggested and several measures of effectiveness are formalized.

by

Steven A. Trogdon

ABSTRACT

The HULL hydrodynamics code has been modified to accommodate the shock wave detonation of an explosive. The modifications have been made relative to the physics burn module in HULL. In order to trigger a detonation a density criteria was developed which, when exceeded, would initiate the detonation. A guide is given as to how to determine this criteria. The modifications have been documented in a change file so that they can be directly incorporated in the HULL system. Comparisons have been made of an impact only scenario with an impact initiated detonation. The scenario is one that attempts to model an actual warehead under impact conditions. Significantly more damage is observed when a detonation occurs.

Distributed Filter Architecture

Implementation with VLSI

And

Expert Systems

by

Asad Yousuf

<u>ABSTRACT</u>

This research project aims at obtaining an architecture
for a distributed filter. Much of the existing literature
was reviewed and the suggested architecture is shown to
have both, memory, speed and complexity advantages over the
conventional filter. Simplified software procedures were
developed to compute table look up contents on the VAX 11/785
and the Numerix MARS 432 series array processors in the
RSPL/IPL laboratories at the Air Force Armament Laboratory.

The proposed architecture was implemented with the VLSI
technology and final die size was estimated to demonstrate
its effectiveness. Software for design/development of
integrated circuits is also suggested.

Finally, expert system techniques applicable to the pattern
recognition environment is suggested to enhance the existing
capabilities of the RSPL/IPL laboratories at Eglin Air
Force Base.

ABSTRACTS
ARNOLD ENGINEERING AND DEVELOPMENT CENTER

RESPONSE OF INFRARED DETECTORS TO PULSED RADIATION

by

Brian P. Beecken

ABSTRACT

The ability of an infrared detector to respond quickly to pulsed radiation is of great importance to a new generation of test systems that sequentially irradiate the individual pixel elements of a focal plane array. An investigation of the response times of IR detectors has revealed a fundamental limit, applicable to all types of detectors, which is close to the pulse lengths (on the order of microseconds) of a current test system. Factors that lengthen the response time of a particular type of detector beyond the fundamental minimum have been examined. The response time constant of an extrinsic photoconductor may be altered by changing such conditions as the applied bias and the background photon flux.

An Analysis of Focal Plane Irradiance Effects on IR Detectors

by

Lee I. Britt

ABSTRACT

An analysis of focal plane irradiance effects due to CO_2 laser radiation is presented. Specific detail is given to vibrational analysis of a germanium acousto-optic cell, induced polarization effects in selected detector media, and laser induced thermal stress phenomena. A model is given that describes laser induced damage for three distinct exposure time periods.

<u>Code Development For Design Of A High Temperature</u>
<u>Hypersonic Facility Mixer</u>

by

Brian R. Circelli

ABSTRACT

Preliminary calculations have been performed that
suggest that PARC-3D may be a suitable CFD code that can be
used as a starting point in developing a code that can be
used in the design of a high temperature hypersonic
facility mixer. The results indicate that the code can
handle large regions of subsonic flow and massive regions
of flow separation. The turbulence model that is presently
being used in the PARC-3D code appears adequate for the
test case presented. There is great uncertainty however,
due to the turbulence model, of the results that will be
generated for the numerical simulations currently being
planned which include surface injection of multiple sonic
or supersonic jets within the mixer.

Laser-Induced Fluorescence of Iodine and Sodium for Application

in Resonant Doppler Velocimetry of Hypersonic Flows

by

Stephen H. Cobb

ABSTRACT

Laser-induced fluorescence in iodine and sodium has been monitored under a variety of conditions in an effort to evaluate these species as potential candidates for use in a hypersonic resonant Doppler velocimeter system. Iodine fluorescence was recorded near 611 nm as a function of temperature, perturber gas pressure, and laser intensity with particular interest in detecting changes in linewidth and location. Absorption of laser radiation by sodium vapor was recorded as a function of temperature in order to determine the absorption line shape which might be observed in the test cell environment.

THERMAL ANALYSIS OF BODIES SUBJECTED TO AERODYNAMIC HEATING

by

John E. Francis

ABSTRACT

The work undertaken on this project was comprised of two completely different problems. One problem was to predict the thermal response of a bomb in an extremely cold environment when subjected to a typical flight mission profile. Of particular interest was to determine if the MIL standards were reasonable. A finite element analysis of the bomb using axisymmetric geometry and 148 elements indicated that based on the assumed flight scenarios and conditions, the MIL standards were reasonable; however, we feel the limiting initial (storage) temperature was extreme. The second project undertaken was to determine the thermal response of EM Windows under a re-entry environment. The windows are diathermanous and a combined conductive and radiative analysis was necessary. For the purposes of this study a planar model was utilized with specularly reflecting boundaries following Fresnel's law. The windows were assumed to emit and absorb but scattering was ignored. The model studied was grey and results were compared to the optically dense and pure conduction solutions.

Diagnostics for Determination of Arc Plasma Parameters of the AEDC HEAT H1 Arc Heater

by

Orlando E. Hankins

Abstract

Arc sources have been used to produce high enthalpy and high velocity gas flows for many years. In particular, vortex-stabilized arc heatershave been used to generate high enthalpy, supersonic flow fields necessaryfor aerospace materials testing. To improve the operation of the present-day devices and to scale to larger arc heaters, the parameters of the gas flows in the heater and the parameters of the arc itself must be monitored or determined. Current and future techniques for the measurement of arc plasma parameters are examined for the HEAT H1 Arc Heater. In particular, the use of visible and UV spectroscopy for the measurement of arc parameters is discussed.

THE DESIGN OF JET MIXERS FOR AN ARC HEATER - AN EXPERIMENTAL APPROACH

by Lang Wah Lee

ABSTRACT

The modeling requirements for the mixing process inside a jet mixer where a stream of high temperature air from an arc heater mixes with another stream of injected air at ambient temperature are studied. Two mixing mechanisms are identified in the mixer and this fact necessitates the use of two sets of governing equations. Normalizing these equations yields six dimensionless parameters which provide the most general conditions for similitude studies. However, two of the parameters, the Grashof number and the Froude number, are found to pose conflicting requirements on the scaling laws and cannot be satisfied simultaneously. Experiments are proposed to find out which one of the two parameters is of lesser importance. If one of these two parameters can be excluded from consideration, then water can be used in pilot mixer testing to yield both qualitative and quantitative information relevant to the design of a prototype mixer. An experimental scheme using mass transfer to simulate the heat transfer process is also proposed.

Laser-Induced Fluorescence (LIF) of

Nitric Oxide (NO)

by

Chun Fu Su

ABSTRACT

Some lifetimes of various electronic states of the NO molecule were collected. A digital computer program (DNOLIF.FOR) was established to calculate and plot the LIF spectrum by a single-photon process. Several options of the code are explained. An LIF spectrum of the vibrational transitions of NO was recorded in the wavelength region between 200 nm and 340nm.

Spectroscopic Monitoring of Exhaust Gases

by

R. H. Tipping

ABSTRACT

Anaylses of existing laboratory spectroscopic data for two molecules, CO and O_2, which are important constituents in both engine and rocket exhausts, have been made in order to compile a database that can be used with existing computer codes to infer temperature and concentration profiles from spectroscopic monitoring of exhaust gases. In addition, a software program was developed that will enable one to ascertain optimal spectral regions for future monitoring of other important molecules, e.g. CO_2 or H_2O.

DISTRIBUTED AND PARALLEL IMAGE AND SIGNAL PROCESSING

by

D. Mitchell Wilkes, Phd.

Ben A. Abbott

Lester E. Lynd, Jr.

Richard S. Souder

ABSTRACT

Automatic programming is used to develop parallel and real-time processing structures under the Multigraph Programming and Execution Environment (MPEE). The MPEE is a high level software development environment that uses AI techniques and graphic editors to model the signal flow within a signal processing system. This work forms the basis of this final report, and is already showing the feasibility of such tools to ease the generation of large-scale signal processing and image processing systems.

MAGNETIC PERTURBATIONS OF THE STRUCTURAL CHARACTERISTICS, PHOTOPHYSICAL PROPERTIES, AND PHOTOCHEMICAL BEHAVIOR OF CRYOGENIC NOBLE GAS-ALKALI METAL MATRICES

by

John W. Kenney, III

ABSTRACT

There is considerable interest in preparing cryogenic cooled rocket fuels containing high concentrations of reactive low atomic mass metals isolated as individual atoms. These metal atoms can increase the specific impulse of the rocket fuel substantially by combining with the oxidizer to generate large amounts of energy. The technique of laser ablation of lithium metal has been shown to be highly effective in producing significantly increased atomic concentrations in cryogenic matrices of the light noble gases. Comparisons with Knudsen oven generated lithium/noble gas matrices indicate that the higher kinetic energy of the ablated lithium atoms enables them to access tighter trapping sites that are unavailable to thermal lithium beams. Ablation experiments are reviewed and compared with details of Knudsen oven experiments. The technique of magnetic circular dichroism spectroscopy as a probe of these high energy sites is discussed and initial approaches to magnetic circular dichroism experiments are discussed.

I_{sp} ENHANCEMENT VIA ADSORPTION/ABSORPTION OF SMALL ENERGETIC MOLECULES ON SOLID PROPELLANTS

by

M. Inga S. Kenney

ABSTRACT

The total payload that a rocket can carry can only be as large as the energy available to lift it into space. That energy comes directly from the rocket fuel. To increase the carrying capacity of a rocket, the energy content of the rocket fuel must be increased without drastically increasing the mass of the fuel itself. One way to amplify the energy of the fuel is to add high energy density materials (i.e., small, very energetic molecules) to the fuel. Azide molecules are one class of high energy density materials.

Studies show that these azide molecules can be added to alkali halides possessing a combination of cation to anion size ratio and a crystal packing structure. The azide--alkali halide adducts exhibit stability over time, yet release significant amounts of energy when heated. Quantitative measurements show azide inclusion in alkali halides between 5-15 percent. These studies indicate that it may be possible to tune the energy content of a rocket fuel by the addition of a high energy content azide which forms a weak bond to the fuel.

STUDIES TOWARD THE SYNTHESIS OF PENTANITROBISHOMOCUBANE

by

Lynn Maruyama Kirms

ABSTRACT

Polycyclicpolynitro cage compounds represent a potential source of new fuel additives. An attractive feature of caged molecules is their compactness and accompanying high strain energy. Addition of energetic groups such as nitro groups to the cage system enhances the explosive properties of these compounds. Two approaches to the synthesis of one polycyclicpolynitro compound, pentanitrobishomocubane, were explored. A key intermediate for the first route required the synthesis of the Favorskii ring contraction product, 10,10-dimethoxy-2-carbomethoxy$(5.2.1.0^{2,6})$deca-3,8-diene-5-one. Synthesis of this precursor was investigated. Synthetic studies on the second route focused on determination of conditions for the allylic oxidation of 9-carbomethoxy-10-hydroxytricyclo$(5.2.1.0^{2,6})$deca-4,8-diene, a difficult transformation to effect. The desired allylic alcohol could be obtained in reasonable yield by use of SeO_2 in dioxane/water. Access to this important precursor will provide entry not only to the pentanitrobishomocubane system, but possibly to the tetranitrohomocubane system as well.

THE PREPARATION OF POLY(IMIDE SILOXANE) POLYMERS:

OXYGEN RESISTANT SPACE POLYMERS

by

Mark A. Kirms

ABSTRACT

Benzophenonetetracarboxylic dianhydride (BTDA) was condensed with several aniline systems possessing siloxane moieties in the 3-position of the aromatic amine. The aniline derivatives were prepared in a series of steps sarting with 3-bromoaniline. The poly(imide siloxane) copolymers produced from these condensation reactions have been shown to be high performance polymeric materials which are resistant to oxygen degredation. Degradation of materials by oxygen is a concern for spacecraft flying in Low Earth Orbit (LEO). It was discovered that two independent routes could be used to obtain the desired poly(imide siloxane) copolymers. Self-condensation of silanol diimide monomers, as well as imidization of diamines with BTDA, gave desirable copolymeric material. In addition to the poly(imide siloxane) copolymers, routes were explored for the preparation of siloxane- graft poly(imide siloxane) copolymers.

NUMERICAL PRESENTATION OF STRESS ANALYSIS, DESIGN AND FRACTURE MECHANICS FOR COMPOSITE MATERIALS AND STRUCTURES

by

Faysal A. Kolkailah, Ph.D., P.E.

ABSTRACT

With an ultimate goal of identifying areas for development of mutual interest for the government, industry and the University for better understanding the finite element approach to analyze and to design composite structures, a research and a survey of the finite element codes was carried out. Also, different fracture mechanics methods coupled with a finite element code were employed to study the stress intensity factor for crack propagation. The results obtained are in a general agreement with the analytical solutions.

Fracture behavior of a composite solid rocket propellant

by

Bipin K. Pai

ABSTRACT

The fracture behavior of a composite solid propellant was investigated by mechanically loading a pre-cracked biaxial strip specimen in an Instron Testing machine. The effect of different center crack lengths and different strain rates of loading were studied by calculating the energies of deformation for each case. In each case, the biaxial strip specimen was loaded at a constant strain rate until the center crack started to initiate. At this point the specimen was unloaded, allowed to relax and then reloaded at the same strain rate to failure. The fracture surface when the material failed was observed to have a "zig-zag" shape. Several specimens were tested to failure and in every case the characteristic "zig-zag" fracture surface was obtained.

ROBUST CONTROL OF A L EXPERIMENTAL GRID
USING REDUCED ORDER MODELS

by

Vittal S. Rao

ABSTRACT

The design of control strategies for large space structures presents challenging problems. One is the presence of a large number of closely-spaced, lightly damped, coupled modes. Another difficulty in controller design arises from the presence of unmodelled dynamics as well as incorrect knowledge of the structural parameters. a robust controller design methodology based on linear quadratic Gaussian with loop transfer recovery (LQG/LTR) is particularly suitable for the control of large flexible structure. A procedure is developed to reduce the computational and implementation requirements by designing LQG/LTR controllers based on reduced order models of the structures. The balance-truncation model reduction method is used to derive a control synthesis model. These reduced order models are used to design linear quadratic regulators with observers and LQG/LTR controllers for A L experimental grid structure.

ABSTRACT

A Neural Network Approach to the Adaptive Control of Large Space Structure
Richard Robertson

This paper presents an attempt to synthesize, explain, and extend the research of Dr. Andrew G. Barto and his colleagues on networks of neuron-like adaptive computing elements for solving complex control problems. Unlike most other adaptive learning systems studied in the past, this approach requires no "teacher" that instructs each individual adaptive element on how it should respond to its inputs. Instead it utilizes a "critic" that is only able to assess certain gross consequences of the collective activity of all the network elements. The key idea is to endow each adaptive element with learning capabilities that are sophisticated enough to enable it to increase its own performance in the face of uncertainty, using any information that is locally available.

This approach is applied to a hypothetical, overly-simplified problem in the adaptive control of a large space structure (LSS). The main purpose here is to illustrate the potential power of these methods in the context of a distributed network of sensors, actuators, and microprocessors. These computing elements are assumed to be connected in parallel for rapid-response adaptive control of a complex, poorly understood LSS dynamical system on-orbit, with noisy, low-quality environmental feedback.

CRYOGENIC HEAT PIPES

by

Larry W. Swanson

ABSTRACT

Research topics important to the development of cryogenic heat pipe systems were reviewed and studied including heat pipe diode and thermal switch configurations, the thermophysical properties of cryogenic fluids, heat pipe computer codes, and the evaporating/condensing meniscus in a capillary tube. A gas gap thermal switch with a solenoid valve or an adsorption block as an evacuation mechanism was found to be the best choice for a monodirectional cryogenic heat pipe system. A preliminary assessment of cryogenic fluids indicated that Ne, O_2, and CH_4 were the most favorable fluids at temperatures of 30 K, 60 K, and 120 K, respectively. Cryogenic mixtures or cryogenic fluids with surfactant additives were found to be potential research areas for improving working fluid heat transport capability. The formulation of a mathematical model describing the evaporating/condensing meniscus in a capillary tube has produced five coupled nonlinear ordinary differential equations. A qualitative assessment of the equation set has shown that both evaporation at the interface and the London-Van der Waals forces increased the meniscus pressure driving force whereas condensation at the interface decreased the meniscus pressure driving force.

<u>DESIGN AND DEVELOPMENT OF A FLEXIBLE</u>

<u>MULTI-BODY DYNAMICS EXPERIMENT</u>

by

Roger C. Thompson

<u>ABSTRACT</u>

The ground-based testing of flexible spacecraft and robotic space manipulators is highly dependent upon the construction of the experimental apparatus. An experimental facility is under development for the study of the behavior of multi-body systems with regard to dynamic interactions, modeling techniques, and control methodologies. A preliminary design was developed for an air film "flotation system" that will minimize the frictional loads on the structure (about a single axis) and simulate, as much as possible, the free motion experienced in an orbital environment. Experimental tests were performed to determine the design criteria of the experiment as a whole, the flotation system in particular, and the degradation of the motion due to the implementation of the air film supports. Other aspects of the multi-body experiment that were examined were the specifications of an optical, real-time position sensing system and the design of the joints of a two-link, flexible test article.

Synthesis of Active Space Structure Vibration Control Systems for an ASTREX Test Article

by

Ji C. Wang

ABSTRACT

Two active vibration control systems and a fine-pointing servo-control system for an ASTREX test article are designed. The independent modal space vibration control system controls the first 20 elastic modes of the structure with 20 point actuators. The control law design for this system is simple, but the control energy level required is too high for a practical space application. The linear quadratic regulator vibration control system which controls the 20 elastic modes with 15 point actuators works well. Its control energy is much realistic than that of the first control system. Unique design problems related to disturbuted parameter control systems are addressed ,these are placement of a finite quantity of point actuators/sensors on the structure, determination of a critical subset of structural modes for control, and data processing for observation spillover reduction and the modal states estimation. In addition , a multi-loop PID control system for a fine-pointing of the test article is studied.

2

Dynamic Mechanical Response of Carbon/Carbon
Composites by Vibrating Reed Measurements

by

Phillip G. Wapner

ABSTRACT

A vibrating-reed apparatus was designed and constructed which
measures the damping capacity of carbon/carbon composites as a function
of temperature; i.e., their ability to dissipate acoustic energy in the
frequency range of 200 to 500 cps between 25°C and 750°C. Typical reed
dimensions are 5 cm x 1 cm x 0.1 cm (L x W x D), and the measurement is
performed by determining the half-peak-height bandwidth of the reed at
its fundamental vibration frequency.

Three specimens of carbon/carbon composites were examined: (a)
pitch matrix; (b) CVD matrix (low density); and (c) CVD matrix (high
density). Damping of specimen (b) was, on average, five times higher
than (a) and (c). Moreover, all three specimens displayed distinctive
shapes of their temperature-versus-damping capacity curves.
Microphotographs of all three specimens seem to indicate that matrix
bonds between fiber bundles, rather than within bundles themselves,
causes the high damping of specimen (b).

ABSTRACTS
ELECTRONIC SYSTEMS DIVISION

CARRIER FREE RADAR

BY

BERYL L. BARBER

AND

KEITH CARROLL, DOUGLAS PEDERSON, GEORGE RAMLOW

Investigation is made into the short pulse radar. Many problems are covered and a look at definitions discussed. Solutions to some of the problems are offered. These investigations were confirmed experimentally.

135

DETECTION PERFORMANCE FOR OVER RESOLVED TARGETS WITH VARYING ENERGY LEVEL IN CELLS

by

Ajit K. Choudhury

ABSTRACT

Ultra wide band radar will soon become a useful tool for detecting small and fast moving objects such as cruise missiles. In ultra wide band radar very short pulses of very high energy are transmitted periodically. Since the pulses are very short the targets are completely resolved into several subscatterers and these subscatterers occupy the different resolution cells spanning the target and as a consequence the target is over resolved. In this research report we study the detedtion performance of over resolved targets with varying energy levels in the different resolution cells for several scatterers.

Analysis of Testability Concepts and its

Application to RSIP

by

Dr. S. Natarajan
and
Bradley K. Herman

ABSTRACT

Testability is becoming an increasingly important design consideration as systems continue to become more complex. In order to be effective, testability must be considered at the earliest possible point in the design phase. This will allow changes to be made to the design when it is still feasible to do so. The incorporation of testability must be done in a systematic manner to be effective. Verification of inherent testability must be done with the proper CAD testability analysis tool and the results should be applied back to the design to improve inherent testability.

ABSTRACTS
ENGINEERING AND SERVICES CENTER

PROPOSED INNOVATIVE SEMI-HARD AIRCRAFT SHELTER

by

Jon B. Anderson, Ph. D.

ABSTRACT

Aircraft shelters at forward bases must meet the criteria of
ease and speed of construction, transportability of
components, modular components and aircraft protection.
Meeting these needs is the object of this proposed
structure. The structure has two forms of protection,
protective elements that are manufactured on site and the
ability to resist loadings by changes in geometry as well as
material deformations.

JP-8 IGNITABILITY

William W. Bannister

Abstract

A <u>reversed</u> relationship exists between molecular weight and ignition temperatures: up to a point, volatile higher molecular weight fuels have <u>lower</u> IT's and are more easily ignited by hot surfaces. Moreover, fuels which would be anticipated to be most subject to free radical effects are actually most resistant to hot surface ignition: free radical effects appear unimportant among factors influencing ignition temperature, and ionic effects, induced by thermoelectric (and, perhaps in some instances, oxyionic hot surface) effects, seem to be most important. For higher members of the alkane family this trend may reverse, resulting in minimum IT's for the C - C alkanes. Branched chain alkanes, arenes and olefins also have higher IT's than analogous straight chain alkanes. Important parameters in governing IT's of fuel components include: (1) the effect of molecular weight on the velocity of the fuel molecule near the hot surface; (2) the effect of rigidity of the fuel molecule on its ability to recoil from the hot surface; and (3) the effect of specific heat of the molecule with regard to ability for dissipation of heat energy within the molecule.

140

Effect of Jet Aircraft Noise on Domestic Goats

by

Emerson L. Besch

ABSTRACT

Noise from low-level jet aircraft is a common occurrence at Air Force installations but numerous complaints have been received about the effect of this stressor on domestic animals and wildlife. In an attempt to evaluate the physiological consequences of jet aircraft noise, domestic goats were housed in two locations on Tyndall AFB: one site was near an active runway but the other was in a more remote area of the base. Although attempts were made to control all variables, factors such as location of the animal sites on base, weather conditions, proximity of goats to predator animals, aircraft operations, flight patterns, and noise intensities all were beyond the control of the investigators. But, general signs, behavioral responses, hematological and blood chemistry changes, and blood hormone assays were performed in both groups. Pen and shelter size and design, availability to feed and water, and husbandry practices were the same among both groups. Although not all data have been analyzed to date, some preliminary conclusions can be made. 1) Both groups displayed a stressor effect of the transport to the base sites; 2) The animals housed at the remote site did not appear to adjust to their surroundings as readily as those housed near the runway site; 3) There were detectable differences in nutrition between the two groups of goats that are thought to be related to the natural flora at the sites; 4) There is some evidence to suggest that the goats near the runway were affected by the noise of the jet aircraft; 5) Future research is needed for which protocol development and variables to be controlled are suggested. Results of hormone assays will be made available in an addendum report.

An Algorithmic System for Subjective Comparisons

by

Anthony Jack Carlisle

ABSTRACT

Specific segments of human-machine natural language interfacing are investigated. Indefinite and ill-defines natural languages phrases concerning quantitative and qualitative measures are parsed and the constituents interpreted as fuzzy language distributions. The components are then mathematically recombined to produce a small range of possible intended values. Similarly, the inverse is also addressed, i.e., matching fuzzy distributions to natural language descriptions. Various techniques are investigated for attempting to fit distributions into the most appropriate phrasings. A methodology for constructing and maintaining a dictionary of such phrases is discussed and demonstrated.

The Study of Alkali Enhanced Cements and Concretes

by

Derald Chriss

ABSTRACT

A study of the effects of alkali hydroxides on cements and mortars has been undertaken. The alkali hydroxides used in this study were LiOH and NaOH. The cements used were Ground Granulated Slag Cement, Portland Cement, a mixture of the above mentioned cements, and a High Alumina Slag Cement. The mortars consisted of the above mentioned cements in combination with sands and clays, with the alkali hydroxides added in variable amounts.

The results indicate that the major role of the alkali hydroxides is to increase the long term compressive strengths of the specimens prepared. In some instances, the alkali hydroxides helped to increase the setting times of the mortars. The results also indicate that specimens containing clay contents of 10 to 15% yield the most promising clay samples, whereas the sand samples prepared yielded no conclusive results with respect to the optimal percentage.

PREDICTION OF THE CAPILLARY PRESSURE-SATURATION RELATIONSHIPS FOR AQUIFERS CONTAMINATED WITH JET FUELS

by

Dr. Avery H. Demond

ABSTRACT

Many correlations exist to relate the depth of aviation fuel in a monitoring well to the thickness of the fuel layer in an aquifer. Unfortunately, many of these correlations require knowledge of the capillary pressure relationships, information which may be difficult to obtain. The purpose of this project was to develop a technique to predict the relevant capillary pressure-saturation relationships from easily measured physico-chemical parameters of a jet fuel spill site. The technique proposed here is composed of three steps: estimating the air-water capillary pressure from grain-size data, estimating the interfacial tensions of air-JP4 and JP4-water from surface tension and density data, and then combining this information to yield the capillary pressure relationships for air-JP4 and JP4-water using Leverett's function. This technique can yield reasonably accurate results for clean JP-4 in Tyndall sand. Modifications may have to be made to make the technique applicable to aviation spills in other soil materials.

CONTAMINATE FLUX REDUCTION

THOUGH IN SITU SOLUBILITY

MODIFICATION

by
Kirk Hatfield and
Joseph Ziegler

ABSTRACT

Research was conducted to develop and test a bench-scale in situ groundwater pollutant partition system. A zone was created within a sand box aquifer where the porous medium had been treated with a decane/mineral oil solution to induce partitioning into the organic phase. Hydrophobic groundwater pollutants were intercepted within the partition zone as they migrated from the source. Contaminate flux reductions of 85 to 99.9 percent were observed in the laboratory. Chemical partition experiments indicate small systems (of 1 meter in length) could remove hydrophobic contaminates under natural hydraulic gradients for 5 to 8 years.

AN FT-IR SPECTROSCOPIC INVESTIGATION OF SURFACTANT ADSORPTION AT THE MINERAL-WATER INTERFACE

by

Dr. Kim F. Hayes

ABSTRACT

An ATR (Attenuated Internal Reflection) FT-IR (Fourier Transform Infrared) spectroscopic study of the adsorption of propionic acid at the γ-Al_2O_3-water interface has been conducted. The main objective of this effort was to demonstrate the feasibility of using ATR FTIR spectroscopy to investigate the structure and orientation of surfactants adsorbed at mineral-water interfaces. The results of the study indicate that the FT-IR method has sufficient sensitivity to detect IR bands of sorbed surfactants. Further work is required before the spectral features that were observed can be fully interpreted. It is postulated that a surface complex was formed between the carboxylic acid functional group of propionic acid and a surface aluminol group. The need for FTIR spectroscopic studies of surfactant-mineral interactions and the application of surfactants to spill sites as a means of spill containment and remediation is discussed.

Biodegradation of Jet Fuel JP-8

by Deborah D. Ross

ABSTRACT

The fate of jet fuel JP-8 was studied in water, water/sediment slurries and soil samples using a quiescent flask test system. For each treatment, killed samples were compared to active samples to assess the relative contributions of biodegradation and volatilization in removing JP-8. At appropriate time intervals, flasks were extracted with CS_2 and analyzed by gas chromatography/mass spectrometry.

In water and water/sediment slurries, the major removal process was evaporation. No significant differences were noted between active and sterilized flasks, indicating that biodegradation was not a major factor in removal of JP-8 under these test conditions. When removal in water alone was compared to removal in water/sediment slurries, greater losses were observed in water alone, indicating that the presence of sediment sequesters the jet fuel rendering it less susceptible to volatilization. Removal of JP-8 from active soil samples was greater than removal in sterilized soil samples, indicating that biodegradation was a significant factor in removal of JP-8 from soil. Thus, strategies to enhance biodegradation would be expected to have greatest impact in the soil environnment.

Further Development of the AFESC Centrifuge Facility

by

Teresa Taylor

ABSTRACT

Through a variety of technical and non-technical subtasks, an effort was made to better prepare the Air Force Engineering Services Center (AFESC) centrifuge facility for use by different researchers. This effort included identification of maintenance and special equipment needs, and assistance in development of an on-site centrifuge library. Research areas of particular military interest were identified, such as blast loading over buried structures. Instrumented pilot tests for assessing the centrifuge capabilities and limitations related to the identified research areas were planned; however, due to lack of appropriate gages and other required support equipment and supplies these tests were not carried out. Several non-instrumented blast tests were successfully conducted, and one non-calibrated instrumented blast test utilizing the newly acquired on-board data acquisition system was conducted.

"STATIC AND DYNAMIC BEHAVIOR OF COMPACTED UNSATURATED SANDS"

by

George E. Veyera, Ph.D.

Abstract

Laboratory tests were conducted to evaluate the influence of microstructure, compaction moisture content, compaction energy, degree of saturation and boundary conditions on the stress transmission characteristics and compressibility of four cohesionless sands. The four soils tested were Eglin sand, Ottawa 20-30, Base (Tyndall) sand and Ottawa F-58 sand. Soil specimens dynamically compacted to a constant dry density at different initial water contents to achieve varying degrees of saturation. Dynamic uniaxial compression tests were performed using a Split-Hopkinson Pressure Bar (SHPB) device to determine stress transmission and stress wave propagation characteristics. Static uniaxial compression tests were performed using an MTS loading system to evaluate soil skeleton compressibilities. A preliminary analysis of the experimental data indicates that both the dynamic and static behavior of the sands tested is strongly dependent on soil microstructure. Initial capillary pressures during compaction, confinement conditions during compaction and testing, and soil grain characteristics strongly affect the development of soil microstructure. From the test results, the most prominent influences of these parameters on soil behavior were observed at intermediate levels of saturation (from about 20 to 60%). In this range of saturations, results generally indicated that stress transmission and stress wave propagation velocity increased in the soil for dynamic tests, and soil stiffness increased in the static tests.

ABSTRACTS
FRANK J. SEILER RESEARCH LABORATORY

The Vibration of Thin Leading Edges

by

Robert A. Granger

ABSTRACT

Leading edge vibrations occur in a wide variety of applications, e.g., rotary dynamics, turbomachinery, and unsteady aeroelasticity. The physics of leading edge vibrations is not clearly defined, so four separate and distinct theoretical investigations were made into leading edge vibrations of thin bodies, each investigation based on a different physical model which in turn is governed by a distinct phenomenon. The first theoretical solution was based on the possibility that flow induced vibrations is an aeroelastic instability problem, similar to one–degree–of–freedom flutter, like leading edge buzz. An analysis was conducted using Lagrange's equation of motion and revealed the unlikelihood the phenomenon is a flutter problem. The second theoretical solution was based on Lamb's formulation that the phenomenon is a highly nonlinear response. The nonlinear equation was solved in closed analytical form using Poincare's method of expanding solutions. The third theoretical model was based on the supposition that the vibrations are caused by the unsteady behavior of the stagnation point. The fourth theoretical model represented vortex shedding past a vibrating leading edge. Preliminary experimental results indicate the fourth model may correctly predict the behavior.

SECOND HARMONIC GENERATION IN OPTICAL FIBERS

by

Lloyd W. Hillman, Stephen McClain, and Mojdeh Anderson

ABSTRACT

Second Harmonic Generation (SHG) is the partial conversion of light at one frequency (the fundamental) to light at twice that frequency (the second harmonic). Although unexpected, highly efficient (>5%) SHG occurs in Ge-P doped silica-core optical fibers. Österberg and Margulis first demonstrated SHG at 532 nm using 1064 nm light from a mode-locked Q-switched Nd:YAG laser. Our goal was to investigate SHG in optical fibers starting with visible light at 514 nm and generating near uv-light at 257 nm. We report our failure to observe such conversion and on our subsequent investigation on the generation of sub-harmonic light.

EVALUATION OF COLD FUSION IN MOLTEN SALT SYSTEMS

by

John A. Lanning

ABSTRACT

The phenomenon of cold fusion was investigated in a neutral molten salt produced from the reaction of 1-methyl-3-ethylimidazolium chloride (MEIC) and deuterium chloride (DCl). The resulting molten salt, $MEI^+DCl_2^-$, provides the source of D^+ ions which were reduced at a palladium cathode under constant current bulk electrolysis conditions. Although D^+ ions from the $MEI^+DCl_2^-$ molten salt melt can be readily reduced at a palladium cathode, the phenomenon of cold fusion was not observed. The major restriction to cold fusion in a $MEI^+DCl_2^-$ melt appears to be limited current densities imposed by nonselective electrolysis of the D^+ ions. Fundamental electrochemical and physical properties of the $MEI^+DCl_2^-$ melt were also examined during the research project.

High Charge Density Batteries Employing

Ionic Liquid Electrolytes

by

John R. Sanders

ABSTRACT

The feasibility of constructing a high charge density battery employing a buffered chloroaluminate ionic liquid electrolyte was investigated. The electrochemical behavior of selected first and second row transition metals was observed in buffered melt to determine if those metals were viable candidates for use as battery cathodes. Copper and *silver exhibited acceptable characteristics.* A simple battery cell with a sodium anode was constructed and the charge/discharge behaviors of cells employing both a copper and a silver cathode were outlined. In addition, the physical characteristics of the electrode materials were observed during and following electrolysis by elemental X-ray analysis and scanning electron microscopy.

A CONVENIENT PREPARATION OF NITRONIUM TRIFLATE AND ITS USE FOR NITRATION

by

Clay M. Sharts

ABSTRACT

The reaction of anhydrous lithium or ammonium nitrate with trifluoromethanesulfonic anhydride (triflic anhydride) catalyzed by nitromethane at 60-70° was found to be the best and most convenient method for preparing nitronium trifluoromethylsulfonate (nitronium triflate). Nitronium triflate could also be prepared in refluxing anhydrous dichloromethane in the absence of nitromethane catalyst, albeit, in lower yield. Nitronium triflate in anhydrous dichloromethane was found to be a useful and convenient nitrating agent for substituting a nitro group for a hydrogen atom bonded to a nitrogen or carbon atom. For example, 2-pyrrolidone dissolved in dichloromethane was converted at room temperature to N-nitro-2-pyrrolidone in 30% yield. In a preliminary study with an aromatic compound, bromobenzene was converted in 70% yield into para-bromonitrobenzene. No ortho-bromonitrobenzene was found when the sample was analyzed by gc/mass spectroscopy. This result is viewed with caution until it has been repeated and the gc/ms analysis confirmed by other methods.

AN INVESTIGATION OF DYNAMIC STALL VORTEX CHARACTERISTICS

by

Julie A. Albertson and T.R. Troutt

ABSTRACT

This research investigation concentrated on expanding knowledge of the unsteady aerodynamics produced by pitching airfoils in uniform flows. The specific experimental situation focused on three distinct areas. A laser–Doppler–velocimetry system was assembled and aligned for use in a water tunnel. Preliminary verification tests show promise for accurate future velocity measurements. A separate flow visualization study involved a two–dimensional NACA 0015 airfoil pitched at constant rates through angles of attack from 0–50 degrees. The experimental results included 35 mm still and video camera flow visualization using dye. These tests showed it was possible to entrain dye within the center of the dynamic stall vortex if it was injected through the airfoil surface. This is a necessary step for any future image analysis or laser–Doppler–anemometry experiments on pitching airfoils in wind tunnels. The use of different colored dye injected at various airfoil locations also helped to clarify the mechanisms leading to dynamic stall, and shows great promise as a future flow visualization technique. A third part of the project involved a preliminary literature review of active control methods. It was determined that acoustic forcing, spanwise blowing, and an external oscillatory flap should yield the most effective control of dynamic stall flows.

Modeling of a Structure-Actuator System with Structure-Borne Reaction-Mass Actuators and Optimal Design of Passive Vibration Absorbers

Prof. Hung Vu and Hao Pham, Graduate student

ABSTRACT

A structure–control system, which possesses dynamic characteristics of large space structure (LSS), was built. The system consists of a beam structure whose first two natural frequencies in bending and torsional modes are low (near 5 Hz) and two structure–borne reaction mass actuators (RMA). The system is modeled and analyzed using finite–element method (FEM) and NASTRAN. Optimal design of passive vibration absorber (PVA) is developed with the aid of MATRIX$_x$. The optimal PVA is designed by applying, with appropriate modifications, the classical formulas of optimal tuning and damping[1,2,3] with the absorber tuned to the lowest structure resonance.

ABSTRACTS
GEOPHYSICS LABORATORY

Impulse Approximation Formalism

for Atom Molecule Collisions:

Exact Theory and Limitations

by

Pradip M. Bakshi

ABSTRACT

An exact formulation of the Impulse Approach (IA) to
atom-diatomic molecule collisions has been developed. Inadequacy of
the Peaking Approximation, especially for high energy loss or small
angle scattering has been established. Validity of IA has been
investigated through general principles such as time reversal
invariance and semi-detailed balancing. While these symmetry
requirements are satisfied for large scattering angles, substantial
violations occur for smaller angles, lower energies and lower
projectile masses. The neglect in IA of multiple collision terms
may be responsible for these departures from symmetry requirements.
Various extensions and suggestions for further work are discussed.

A Statistical Analysis of the Geomagnetic Indices, 1932-1989

by

Chi Hau Chen

ABSTRACT

Geomagnetic indices K_p and a_p have been used for many years in statistical studies correlating magnetic activity with other phenomena occurring on the sun, in the interplanetary medium and in the magnetosphere. An excellent statistical analysis of these indices was made by earlier AFGL researchers for the years 1932-1971. The present study incorporates the data since 1971 in the statistical analysis. Although there have been little change in statistical parameters, the overall trend has been a slight increase in the geomagnetic activity in recent years. By using the modern spectral analysis techniques, the power spectra of the yearly K_p, the sunspot numbers and the solar flux numbers are calculated to determine the major periodicities. The spectral analysis also allows us to correlate the geomagnetic indices with sunspot numbers and the solar flux.

CUMULUS PARAMETERIZATION IN NUMERICAL PREDICTION MODELS:

PROPOSAL FOR A NEW PARCEL-DYNAMICAL APPROACH

by

Phanindramohan Das

ABSTRACT

The available cumulus parameterization schemes are based on: (i)
Kuo's single class of undiluted towers and its modifications; (ii)
Arakawa and Schubert's ensemble of cumuli with varying tops under quasi-
equilibrium large-scale forcing; (iii) Lindzen's ensemble of cumuli with
varying tops as well as bases; and (iv) Bett's systematic adjustment
toward a quasi-equilibrium atmosphere. Physically the Arakawa-Schubert
scheme is most nearly complete; but it is both difficult to implement
and prone to undesirable heating in the lower atmosphere. The physical
basis of the Kuo scheme is obscure, while those of Lindzen, and Betts
are ad hoc.

A new concept for a cumulus parameterization scheme is proposed and
will be based on the physics and dynamics of an undiluted tower; it will
use moisture convergence to determine cloud coverage and compensatory
subsidence for cumulus heating. A microphysical scheme will determine
precipitation formation and fallout. The scheme will be closely tied to
the convective available potential energy (CAPE), appropriately cor-
rected for the negative buoyancy due to condensed water loading.

Estimating Characteristics of Chemical Explosions in New England and Eastern Kazakhstan Using Local and Regional Seismic Data

by

Alan L. Kafka
and
Matthew Jacobson-Carroll

ABSTRACT

One of the problems associated with monitoring a comprehensive nuclear test ban treaty is that of discriminating between small explosions and earthquakes based on seismic data. Chemical explosions are used routinely in the mining and construction industries in both the United States and the Soviet Union. These chemical explosions usually occur at very shallow depths (a few tens of feet), and probably are all shallower than a few hundered meters. Most nuclear explosions are detonated at depths of less than about one kilometer, and the deepest underground nuclear explosions are a few kilometers deep. On the other hand, most earthquakes occur deeper in the earth's crust. Thus, accurate estimation of the depths of seismic sources can be helpful in discriminating earthquakes from explosions. During the past several years, the Principal Investigator (PI) for this summer project has been studying the use of short-period Rayleigh waves (Rg) as a depth discriminant for seismic sources in New England. The research that we conducted this summer was primarily an extension of the PI's research on Rg as a depth discriminant. In addition, we investigated other aspects of estimating characteristics of chemical explosions from local and regional seismic data. The primary goal of our research this summer was to record seismic data at field sites located at near-regional distances from quarry blasts.

A STUDY OF THE WATER VAPOR CATION-NEUTRAL REACTIONS

by

C. Randal Lishawa, Ph.D.

ABSTRACT

The charge transfer, atom pickup, and proton transfer cross-sections for the reaction $H_2O^+(D_2^{18}O^+) + H_2O(D_2^{18}O)$ were measured over center-of-mass energies from approximately 1 eV to approximately 25 eV. The cross-sections for the charge transfer process decreased from about 16×10^{-16} cm^2 at 1 eV to about 8×10^{-16} cm^2 at 3 eV. The charge exchange cross section then remained constant to 25 eV.

The cross-section for proton transfer reaction behaved similarly with the cross-section falling from about 4×10^{-16} cm^2 at 1eV to about 1.0×10^{-16} cm^2 at 3 eV. The proton transfer cross section then fell slowly to about 0.3×10^{-17} cm^2 at 25 eV.

The cross-section for hydrogen pickup fell from about 1.3×10^{-16} at 1 eV to about to 0.2×10^{-16} cm^2 at 3 eV before leveling out until 25 eV.

Time-of-flight measurements for the charge exchange products show that the products are produced at near thermal energies. For the atom pickup products, the time-of-flight measurements show distinctly forward peaked distributions at product ion energies at about 80% of the primary ion energy. The proton transfer time-of-flight measurements showed two peaks in the spectra, the first is attributed to a very fast $^{18}OD^+$ product and a second slow (near thermal energy) peak attributed to the transfer product.

ACIDITIES OF IRON HYDRIDE AND VARIOUS TRANSITION-METAL COMPOUNDS; REACTIONS OF IRON AND IRON CARBONYL ANIONS

by

Amy E. Stevens Miller and Thomas M. Miller

ABSTRACT

Four projects were carried out:

1. A number of transition-metal acids were synthesized, and their gas phase acidities were bracketed by determining proton transfer reaction rates with of negative ions of known basicity. One of these compounds, $HCo(PF_3)_4$, proved to be stronger than any other known acid in the gas phase.

2. Proton transfer rates for Fe^- reacting with a variety of acids were measured. The gas phase acidity of FeH was determined to be between that of propionic acid ($\Delta H_{acid} = 347.3 \pm 2.3$ kcal/mol) and acetic acid ($\Delta H_{acid} = 348.5 \pm 2.3$ kcal/mol).

3. Ion-molecule reaction rate coefficients were measured for $Fe(CO)_n^-$ (n = 0-4) interacting with methyl halides. Nucleophilic displacement occurs when energetically possible, yielding $Fe(CO)_nCH_3$ and a halide anion. If this reaction channel is energetically closed, ligand exchange may occur. The reaction rates measured in projects 2 and 3 are the first to be measured with the atomic iron negative ion.

4. Collision-induced dissociation of $Fe(CO)_n^-$ (n = 1-4) with He was studied in an attempt to determine the carbonyl bond energies. Because of the difficulty of calibrating the collision energy scale, the results are estimated to be uncertain by about 0.5 eV.

CO2(4.3μm) VIBRATIONAL TEMPERATURES AND LIMB RADIANCES

UNDER SUNLIT CONDITIONS IN THE 50-120 KM ALTITUDE RANGE

by

Henry Nebel

ABSTRACT

Vibrational temperature profiles as functions of altitude under sunlit conditions have been calculated for the 4.3 μm, 2.7 μm and 2.0 μm absorbing states of carbon dioxide which contribute to 4.3 μm radiation. These calculations have been performed using a non-equilibrium line-by-line infrared radiation transport code (ARC) developed at the Geophysics Laboratory. The vibrational temperature profiles are then used to calculate integrated radiance from the 4.3 μm bands of CO_2 in a limb view for the 50-120 km altitude range. The calculated radiances are in good agreement with day-time measurements obtained by the Spectral Infrared Rocket Experiment (SPIRE)*.

*Stair, A.T., et. al., J. Geophys. Res. 90, 9763-9775 (1985).

Estimating Solar Flare Proton Fluences From 1850

With Tritium Data

by

Hugh Nutley. Ph. D.

ABSTRACT

Arrangements were made to get annual samples from 1850 of a high geomagnetic latitude glacier. These samples will give an estimate of solar flare proton fluences based on the tritium in them. Furthermore, the measuring of tritium by mass spectrometer was studied and also correlations between tritium concentrations, above-ground nuclear explosions, and proton fluences was investigated. Finally, a more exact method of calculating ^{14}C production by solar flare protons and galactic cosmic rays was found so that a student can do the calculation for his honors project this fall. Tritium and ^{14}C are similarly produced and knowledge of one is useful in understanding production of the other.

Electric Fields in the Middle- and Low-Latitude Ionosphere and Plasmasphere

by

Craig E Rasmussen

ABSTRACT

Previous research has effectively shown that middle- and low-latitude electric fields are primarily caused by neutral winds in the dynamo region of the ionosphere. These electric fields are important because they are indicative of tidal motion in the Earth's atmosphere and of coupling processes between the thermosphere and the ionosphere. Middle- and low-latitude electric fields are also of interest to the Air Force at this time because of the Combined Release Radiation Effects Satellite (CRRES) which will be making measurements in the Earth's plasmasphere and radiation belts. This report describes research related to middle- and low-latitude electric fields which was done at the Geophysics Laboratory in conjunction with the Summer Faculty Research Program. The research was primarily divided into two areas: Electric field data from the double probe, vector electric field instrument (VEFI) on the DE 2 spacecraft were examined in the magnetic latitude range from $30°$ to approximately $50°$. Electric fields in this latitude range are typically of the same order as instrumental errors so the amount of reliable data is often limited. Thus, a new technique was evaluated to see if the amount of useful data could be increased. This new technique showed promise but further evaluation is necessary. The other area of research involved an extensive review of the scientific literature related to mid- and low-latitude electric fields. This review was done in order to devise a research program which can be undertaken in support of the CRRES program.

REVIEW AND ASSESSMENT OF CARBON DIOXIDE

PRESSURE BROADENING DATA

by

Robert E. Willis

ABSTRACT

A review was conducted of all journal articles pub-
lished since 1965 that relate to the pressure broadening of
carbon dioxide absorption lines. For each broadening
species, the published data were compared by vibrational
band, branch (P, Q and R) and experimental technique.
Various systematic differences between branches and bands as
a result of technique are reported. Recommendations are made
concerning which data to use for the HITRAN database.
Comparison of all data gave a broadening coefficient of O_2,
relative to N_2, of 0.85. The variation of halfwidth with
temperature was also reviewed, and recommendations made for
values of the temperature coefficient n. Theoretical cal-
culations of both halfwidths and n are compared to the
experimental values.

Non-Uniform Clouds

by

John G. Wills

ABSTRACT

Calculations of light propagation through non-uniform clouds are time consuming. This is because they involve computations in three space dimensions. But such calculations are essential if one is to model the realistic flow of light energy through the atmosphere.

In an approach similar in spirit to the nuclear optical model, the results of a Monte Carlo simulation of light scattering by a cube are parameterized so that the multiple scattering can be represented as a *single scattering*.

Various shapes of non-uniform clouds can then be constructed by stacking these cubes, and cubes for clear atmospheric areas, in any desired manner. The calculation of the scattering of light by a cloud then only involves a single scattering by each cube. This approach is much faster than the Monte Carlo simulation of the full cloud.

The method has been tested on large cubic clouds, on horizontal layer clouds and on vertical column clouds. The results are the same as full Monte Carlo calculations of these same clouds.

Examples of scattered clouds have been performed to examine the cloud-cloud interaction in the scattering of light in a non-uniform cloud field. The amount of upwelling light is found to be a non linear function of the fraction of cloud cover.

169

ABSTRACTS
ROME AIR DEVELOPMENT CENTER

Design Considerations in the Implementation of ACT Programmable

Transversal Filters

by

Charles J. Alajajian

ABSTRACT

A well known computer program by Parks et. al. was used to design finite-impulse response (FIR) filters with linear phase for a programmable transversal filter (PTF) based upon acoustic charge transfer (ACT) technology. The program employs the Remez exchange algorithm to minimize the weighted Chebyshev error in approximating a desired ideal frequency response.

Because the programmable filter hardware cannot represent the FIR filter coefficients exactly (currently, only to 6 bit accuracy using fixed-point numbers), a quantizer subroutine was developed in order to simulate the finite wordlength effects.

The non-destructive (current) sensing (NDS) electrode structures that are utilized in the physical device result in an undesirable rolloff in the frequency response of the actual filter. An analytic expression for the transfer function and impulse response of an NDS tap has been derived in the literature [15]. This undesirable degradation in the frequency response was cancelled by predistorting the filter response so that its passband compensates for the deterioration [7].

Automating Finite Element Reliability Assessment of Microelectronic Components

by

Ian R. Grosse

ABSTRACT

This report details an investigation of two related research areas of critical importance for finite element reliability assessment of microelectronic components. The first area was automatic finite element mesh generation. For this task, two software codes, AMEKS and FASTQ , were obtained for evaluation purpos m the artificial intelligence and engineering analysis groups at Sandia National Laboratories. The FASTQ software was successfully ported to the Computer Aided Systems Engineering Branch's VAX computer located at Rome Air Development Center, while various machine and software incompatibilities prevented porting of the LISP-based AMEKS code to the AI Lab's TI-Explorer workstation despite much effort. The FASTQ software demonstated powerful two-dimensional meshing capabilities and was easily interfaced to the commercial finite element code used by the Computer Aided Systems Engineering group. For the second research area, various adaptive meshing algorithms were studied, and a new adaptive meshing algorithm was developed. The algorithm and how it can be implemented with FASTQ and a commercial finite element code is discussed in the report.

172

DESIGN FOR TESTABILITY: FROM COMPONENTS TO SYSTEM

BY

JOHN HADJILOGIOU

ABSTRACT

The purpose of this study is to illustrate the interrelationships between various component/system design implementations and overall testability related features.

Inherent to every design are considerations, such as power, percentage of detection, diagnostic capabilities, ease of testabili'ɣ, acquisition time, reliability, maintainability, availability, and liιe-cycle costs. The uocumentation of these interrelationships and their cost trade-offs will ease the task of the design engineer with the selection and deteɾmination of system specifications and attributes.

Testability features, together with the functional description of the system and other design features, must be addressed at the beginning of the design cycle for a successful product. Integrating testability into a system should result in maintainability improvement, which in turn, will increase its availability. This is true provided these added testability features did not appreciably degrade the original system's reliability. Every effort must be made to keep the reliability of the testable system to its original (prior to the testability integration features) reliability level.

High Resolution Research Facility

by

Henry F. Helmken

Abstract

In order to improve the performance of Over The Horizon
(OTH) radar, communication and direction finding systems,
Rome Air Development Command is interested in developing a
national High Frequency (HF) test facility. At the facility,
experiments aimed at understanding the nature of clutter,
especially auroral clutter, would be carried out. It would
also serve as field site for testing new hardware concepts.
In order to quantify the requirements, a report has been
prepared which outlines a phased approach to the
establishment of such a facility. In addition to the report,
several hardware changes to the existing test equipment at
Ava, N.Y. and Verona, N.Y. were tested via computer
simulation and laboratory experiment.

ITERATIVE V&V: A MODEL FOR VERIFICATION AND VALIDATION IN THE RAPID PROTOTYPING LIFE CYCLE

by
Stuart H. Hirshfield

ABSTRACT

This paper addresses the role of verification and validation (V&V) techniques in the rapid prototyping (RP) model of software development. Unlike software developed by more traditional means (i.e., according to the "waterfall" model), RP software is characterized by evolving requirement specifications, informal intermediate-level (detailed requirements, design) documentation, and an increased reliance on functional testing as a means for both evaluating and influencing system development. These differences dictate to a large degree which V&V activities can be applied at different stages of development, and how they can be applied. While conventional V&V techniques are by and large still applicable, the order and manner in which they are applied is project dependent. That is, an RP life cycle necessitates more operational changes to V&V activities than theoretical ones, and the changes are dictated by the particular RP model used to develop the software. This paper proposes a general V&V scheme that is customized both operationally and theoretically to the RP model, and can be adapted to any RP development effort.

CAPABLE NEURAL NETWORKS FOR APPLICATIONS IN DATA ANALYSIS

by

O. G. Jakubowicz, PhD.

ABSTRACT

A summary of desirous neural network properties for automatic aids for intelligence analysts was derived. A neural network system which is capable of all of the desired properties was modeled. A working computerized prototype was constructed in a short period of time that exhibited some of the properties (generalization, noise tolerance, translation, relational distortion and partly rotation invariance). The other properties, autolearning, autoassociative restoration, focus of attention and segmentation, have been demonstrated in a parent system, the Neocognitron. The intermediate layers are organized into Kohonen-like feature maps to aid the generalization property and the 'bubbles' of localized activity formation. A vision-like Y cell preprocessor acts to pick out the areas of a larger 80x80x6 (for 6 types of input) input space that have the highest possibilities of containing pre-defined 'interesting', sought after patterns of tactical activity. Output values represent the probability of particular patterns being present in the input. Together with an accompanying man machine interface program the computerized system can be used for demonstration purposes of a robust, multi-talented neural net for data analysis. In its present form it could also be easily interfaced to the Intelligent Analyst Associate system when it is ready.

A Study of Interacting Tunneling Units with Possible Application to High Temperature Superconductors

Dr. Michael Klein and Timothy Mavor, Graduate Student

ABSTRACT

Most amorphous and glassy materials exhibit anomalies in their low temperature thermal properties. Very similar anomalies were observed in a number of high temperature superconductors. Whereas it is believed that these anomalies arise from the presence of tunneling states in the solid, so far there is no microscopic model for these tunneling states. Recently I examined a system of tunneling dipoles distributed in alkali halides and found that they give glasslike properties at low temperatures. Thus dilute tunneling dipoles present a microscopic model for glasslike properties. The purpose of this research to derive the thermal properties of dilute quadrupoles and examine whether they can explain the temperature-dependent variation of the sound velocity of some high T_c superconductors.

DESIGN OF A PRACTICAL BINARY PHASE-ONLY OPTICAL CORRELATOR

by

William L. Kuriger

ABSTRACT

Procedures were investigated for designing optical correlators based on binary phase-only filters. Implications of the procedures were investigated by use of computer simulations. The report contains correlator and filter design information and samples of simulation results. It is a reduced version of a report submitted at the research location.

A Computer Model for Temporal Frequency Spectrum
of Vegetation Clutter Return

by

Jay K. Lee and Lynda Tomlinson

ABSTRACT

A computer model that incorporates polarization
information is developed for predicting the temporal
frequency spectrum of the clutter return from forest
vegetation at C-band and S-band based on the geometric
and physical parameters of the vegetation.

It is assumed at these frequencies the predominant
backscattering occurs from leaves in the forest canopy.
A multiple scattering model that incorporates vegetation
density, moisture content of leaves and correlation
lengths as adjustable parameters is used to calculate the
radar cross section of the stationary canopy for both
horizontal and vertical polarization.

The temporal frequency spectrum of the backscattered
radiation is estimated under windy conditions, by
assuming the leaf velocity in the direction of incident
radiation is described by a quasi-harmonic oscillation.

The effect of adjustable parameters on the resulting
spectrum is anaylzed.

Material Effects in Photoconductive Frozen Wave Generators

by

Robert M. O'Connell

ABSTRACT

Material effects in photo-conductive frozen wave generators fabricated in semiconductor-based microstrip transmission line have been studied from three perspectives: frozen wave propagation in the line; the spacing between switches in a frozen wave generator and their maximum number; and the switching behavior of the gap-switch itself, which is modeled as a lumped-element, modified Ebers-Moll equivalent circuit.

Frozen wave propagation is influenced by both the static relative dielectric constant ϵ_r and the electrical conductivity σ_d of the semiconductor substrate and by the electrical conductivity σ_c of the strip conductor of the microstrip line. The maximum number of switches in a frozen wave generator is limited by the recombination lifetime τ of light-induced carriers in the semiconductor substrate. This directly affects both the center frequency and the bandwidth of the frozen wave. The switch spacing depends on both ϵ_r and τ. The behavior of the photoconductive switch depends on the dielectric constant ϵ_r , band gap E_g, absorption behavior (quantu efficiency η and absorption coefficient β), and reflectively r of the semiconductor, on the lifetimes τ and mobilities μ of charge carriers in the semiconductor, and on the injection efficiency η_i of the strip conductor/semiconductor junction. Some of these relationships have yet to be determined, especially in the saturation regime.

Finally, the analysis has also shown that in all three cases, there is a complicated interplay between geometric factors and material properties which might best be studied numerically using pre-existing simulation software.

PARALLEL PROCESSING FOR
ASSOCIATIVE SEMANTIC SPACE ANALYSIS

by

Sally Yeates Sedelow

ABSTRACT

Associative semantics refers to the "definition" of a word through
its association with other semantically closely-related words. For the
natural languages (e.g., English), which are the focus of this
research, thesauri provide the most readily available whole-language
compendia for associative semantics. Through research extending over
more than twenty-five years, my research groups have determine_ Roget's
International Thesaurus, 3rd edition (1962) to be a reliable guide to
English semantic space when our mathematical model (Bryan, 1973, 1974)
is employed (Brady, 1988; Patrick, 1985; S. Sedelow, 1969, 1985, 1987;
S. Sedelow with Mooney, 1988; S. Sedelow and W. Sedelow, 1969, 1988,
1989, 1986 (The Lexicon...), 1986 (Thesaural...); W. Sedelow, 1985,
1987, 1988; W. Sedelow and S. Sedelow, 1969, 1987; Talburt and Mooney,
1989 (Determination...), (The Decomposition...); Warfel, 1972).
Efforts to get at structural components of the Thesaurus through
programming conventional computers have posed major difficulties. The
focus of this research has been to explore the appropriateness of
parallel processing for our mathematically-guided analysis of
associative semantic space.

181

CHARACTERIZATION OF AN OPTICAL SWITCH

B Y

KHAJA F. SUBHANI

ABSTRACT

Numerous theoretical models exists for predicting multiple quantum well laser operation. It comprises of single cavity, with simplest device geometry based on one dimensional analysis. Preliminary investigations reveals that three dimensional modelling is essential for accurate characterization of an optical switch with realistic geometry and with different laser cavities of complex nature. A simple model to predict switching action based on the concept of laser bistability representing laser beam propagation within the cavities is also presented. Finally, directions for the follow-up research work to be performed at the parent institution are highlighted.

Study of a Communication Receiver for Spread Spectrum Signals

by

Donald R. Ucci & Ernest Rho

ABSTRACT

A simulation of a Frequency Domain Receiver (FDR) was ported from an IBM-type Personal Computer to a Commodore Amiga Multi-tasking Personal Computer System. The enhanced speed and graphics capability of the Amiga was exploited. This system will serve as a workstation for testing communication systems of the future at RADC.

A simulation of an Adaptive Nonlinear Coherent Processor (ANCP) was performed. The signalling environment was presumed to have present non-Gaussian interferers. It is known that, when the received signal contains highly non-Gaussian components, a receiver based on the likelihood function shows substantial performance improvement over correlation processing. This nonlinear demodulator requires the learning of the interference Probability Density Function (PDF) and subsequent generation of an appropriate nonlinear function. In this study a histogram approach was used for estimation of the PDF and the nonlinearity was generated from this estimate.

Several problems were revealed during software simulation. These included PDF estimation at singular points, appropriate smoothing for the histogram and determination of the optimal number of samples and bins for the PDF histogram.

Tactical Command and Control:

A Group Problem Solving and Decision Making Process

by

William A. Wallace

ABSTRACT

The command and control process can be viewed as consisting of problem solving and decision making tasks. Many of these tasks are carried out by groups either in a face-to-face setting or geographically dispersed. This paper provides a conceptual framework for research on the use of decision aid technologies for supporting groups in TAC engaged in problem solving and decision making tasks.

Neural Networks for Invariant Pattern Recognition:
A Survey of the State of the Art
by
James S. Wolper

Abstract
Several techniques have been proposed for the use of Artificial Neural Systems (Neural Networks) to do Invariant Pattern Recognition. Many of these methods were simulated during a Summer Faculty Research Project. This report classifies the methods, discusses their implementation, and evaluates them.

Optical Beamforming for
Phased Array Antennas

by

Henry Zmuda

ABSTRACT

Microwave carrier generation along with the signal processing required
for dynamic beamsteering of a phased array antenna is accomplished using
optical components. It is shown that a deformable mirror spatial light
modulator can establish an arbitrary optical phasefront which is direct-
ly converted to RF phase information by means of an optical heterodyne
system. Experimental results which simulate the performance of the ac-
tual system are presented. Additionally, a different system is proposed
using a spatial light modulator similar to the one above which offers
the possibility of achieving extremely wideband response.

AN EXPERIMENTAL PROTOCAL FOR LINE-OF-SIGHT SLEWING, OPTICAL ALIGNMENT AND AFT BODY STATION KEEPING CONTROL EMULATION

by

Thomas A. W. Dwyer, III
David S. Andreshak
Toby B. Martin

ABSTRACT

This report records the results of an evaluation of the capability of the TACOS pointing and tracking test bed at WL/ARCD for directed energy weapon or space telescope slewing, optical alignment and aft body station keeping control emulation, as well as the adaptation thereto of appropriate parameter estimation and control procedures.

LINKING THE TWODANT S_N CODE AND THE MCNP MONTE CARLO CODE

by

William L. Filippone

ABSTRACT

A computer code SNMCSRC has been written to couple the TWODANT S_N code with the MCNP Monte Carlo code. The system of codes has been installed on the SUN computer at the weapons lab and is intended to be used to determine the radiation dose to sensitive areas of nuclear powered spacecraft. The code SNMCSRC reads the binary angular flux file produced by TWODANT and produces a surface source input deck for a subsequent MCNP calculation. The location of the source plane is selected by the user and forms an exterior surface for the MCNP run. Thus, TWODANT can be used to analyze the reactor and possibly the reactor shield, while MCNP can be used to track particles through the spacecraft.

SIMULATION OF A SPRAY REACTOR FOR GENERATING EXCITED OXYGEN

by

William M. Grissom

ABSTRACT

A one dimensional dynamic simulation was developed to model the droplet-gas reacting flow in a proposed spray reactor for generating excited oxygen. In this reactor uniform-sized droplets of hydrogen peroxide in a basic water solution are sprayed into a flow of gaseous chlorine. The reaction produces oxygen in an excited electronic state, termed the "singlet delta" state. This excited oxygen is used to collisionally excite iodine gas in a chemical laser.

The simulation follows the droplets as they flow down the generator. The relative motion between the droplets and gas determines the gas phase mass transfer coefficient. The liquid phase mass transfer is modelled as gas absorption by a flowing liquid film. The contact time between the gas and liquid is calculated by an internal circulation model in the droplet. The liquid becomes saturated with oxygen, so that the generated oxygen immediately comes out of solution, with negligible deactivation in the liquid. The excited oxygen is deactivated by collisions with other molecules, with droplet surfaces, and the walls. The purpose of the simulation is to guide selection of the operating parameters to optimize the excited oxygen yield and the chlorine utilization.

MODELING THE RESPONSE OF PRESSURIZED COMPOSITE
CYLINDERS TO LASER DAMAGE

by

Harry A. Hogan
and
Stuart J. Harbert

ABSTRACT

The response of pressurized composite cylinders to laser damage is
a problem of interest to the Air Force and the Weapons Lab because of
its application to the Strategic Defense Initiative. Current numerical
models for this problem, however, are generally inadequate to allow
predictions outside the range of parameters for which a large
experimental database already exists. Thus, the advantages of modeling
cannot be fully exploited. In an effort to develop an improved model
that includes more basic mechanisms and first principles, several
related tasks were undertaken. First, current models and experimental
test results were evaluated and studied in order to gain as
comprehensive an understanding of the problem as possible. In
addition, the broader composite materials research literature was
searched and reviewed in an effort to establish the current state of
the art in areas closely related to the problem at hand. The two
topics focussed upon were delamination at free edges and failure
analysis and prediction for laminates with holes or notches. Finally,
preliminary modeling activity was initiated at WL/TALE using in-house
software and hardware. Short-term recommendations for improved
modeling center on evaluating the effects of delamination on critical
stress states near the damage site and implementing more advanced
failure criteria for predicting laminate rupture.

SCATTERING OF ELASTIC WAVES IN A RANDOM

INHOMOGENEOUS SOIL MEDIA

by

Duane R. Sanders

and

Robert W. Bolton

ABSTRACT

A literature survey of wave scattering models applicable to random homogeneous soil media was performed. From the literature review the Kramers-Kronig method for calculating the dispersion in a random inhomogeneous media was selected. The Kramers-Kronig method was implemented into a plane wave computer code and a parameter study was performed in which the scatterer size, scatterer concentration, and elastic constants for the scatterer and matrix were varied for a range of values typical of the McCormick Ranch, Albuquerque, NM. It was determined that the Kramers-Kronig method was able to model the variability in acceleration spectra recorded at the McCormick Ranch due to a buried detonation for different azimuthal directions by considering: different combinations of scatterer size, scatterer concentration, elastic constants of scatterer and matrix and Q that are typical of the variability of these parameters in different azimuthal directions at the McCormick Ranch. The results of the study indicate that the Kramers-Kronig method does have application in modeling the wave propagation characteristics in a random inhomogeneous media.

A POSSIBLE NEW SOURCE OF NEGATIVE HYDROGEN IONS

by

Hugh E. Siefken

Abstract

By directly heating lithium hydride in a vacuum to evolve the large amount of stored hydrogen from the crystal lattice, experiments have been done which indicate this material and probably other alkali metal hydrides can produce a significant amount of negative hydrogen ions. The ion current appears to be emission limited and saturates with extraction voltage. The electrons accompanying the negative ions were removed by a magnetic trap. A Wien velocity filter was designed and built to provide definite mass analysis of the extracted ion species. The amount of ion current extracted and analyzed is closely related to the temperature of the sample and to the rate at which the temperature is changed.

Please regard the new ideas contained herein as proprietary to WL and to Charles Stein in particular.

The Effect of a Maverick Missile on a Test Antenna at Spacings Less than $2D^2/\lambda$

by

John W. Silvestro

ABSTRACT

Testing of weapon system susceptibility to RF energy may require placing the system in the near zone of the transmitting antenna. Since scatterers that are not in the far zone of an antenna may influence the antenna, this poses a problem. A test of the Maverick missile later this summer, will require such placement. To estimate the effects this near placement has on the antenna, low power S and L band coupling tests of the complete experiment using Narda 644 and 646 horns and an instrumented Maverick missile nose cone were performed. In conjunction with these tests a simplified computer model of the scattering was also developed using the NEC-BSC scattering code. The computed results for predicting the change in the horn's voltage reflection coefficient agreed quite well with the measured results. These reflected field amplitudes, at the horn, were on the order of 24 dB down from the incident horn fields. As a test of the effect on the antenna's radiated power, the fields scattered back to the horn aperture by the nose cone were assumed to be totally re-reflected by the horn. The re-scattered fields at the missile were found to be almost 20 dB down from the original fields levels. The small values for both of these effects at the distances analyzed (as close as $\sim 2\lambda$) show that the missile-horn interactions should be small enough to be ignored in this situation.

ABSTRACTS
AERO PROPULSION LABORATORY

PRELIMINARY REPORT ON MEASUREMENTS OF TURBULENT TRANSPORT IN A RIB ROUGHENED CHANNEL

M. K. Chyu
Dept. of Mechanical Engineering
Carnegie Mellon University
Pittsburgh, PA 15213

R. B. Rivir
POTC
Wright Research Development Center
WPAFB, OH 45433

ABSTRACT

The primary focus of this study i_   investigate both momentum and heat transfer in a channel with two of its bounding walls roughed by transverse ribs. Transverse ribs generally arranged in a periodic fashion exist in the internal cooling passage of a turbine blade or vane. To study the momentum transfer, it uses hot-wire anemometry for the measurements of flow and turbulence distribution over an complete period. The heat transfer study utilizes the thin liquid crystal method operated in a transient mode. Detailed local heat transfer coefficient is inferred according to the color response of the liquid crystal. Fabrication of the test rig has been completed, and measurements are currently under way. In addition to description of the experimental system, this report contains a literature review of rib surface heat transfer and results of a preliminary study using analogous mass transfer. The latter has provided the on-going study with valuable background information and basis for future verification and comparison.

Experimental Study of Electronic Excitation of Xenon by

Electron Impact

by

Jerry Clark

ABSTRACT

The novel application of fourier spectroscopy has been applied to acquire optical excitation functions for the 5d levels of atomic xenon. These electron impact excitation functions were measured from the onset to 150 eV. Cross sections for 5d[3/2]1, 5d[3/2]2, 5d[5/2]2, 5d[5/2]3, 5d[1/2]0, and 5d[1/2]1 levels are reported. Transitions from these levels include the 3.5 μm, 3.27 μm, 2.65 μm, 2.03 μm, and 1.73 μm lines all of which are strong laser transitions. The pressure dependence of the optical cross sections was analyzed yielding collision excitation transfer rates for two of the 5d levels.

Dr. Wayne Eckerle

No Abstract Submitted

FLOW LIMITATIONS IN MICRO HEAT PIPES

F.M. Gerner and J.P. Longtin

ABSTRACT

This paper examines the basic physics governing operation of micro heat pipes. It also explores the operating limits which will determine the maximum heat transfer capability of these devices. These devices, which utilize latent energy to transport thermal energy at very uniform temperatures, will be extremely useful for dissipating the large heat fluxes expected in the next generation of computers.

A simple analytic model is shown to predict the operating limit for 1 mm hydraulic diameter devices. This model is then used to show the expected effectiveness for 100 μm hydraulic diameter devices currently being built. Not only is the expected heat flux large, 10 - 15 W / cm^2, the temperature drop should be very small, of order $0.01^\circ C$.

Prof. Thomas Lalk

Abstract not publishable at this time

Large-Scale Motion and Coherent Structures in

Axisymmetric Swirling flow of a Dump Combustor

by

Baruch B. Lieber, Ph.D.

ABSTRACT

The flowfield in an axisymmetric dump combustor is investigated under isothermal conditions with a two component laser Doppler velocimeter. The combustor can accomodate different coaxial swirlers with a swirl number ranging from zero to 0.5. The raw data is collected and stored permanently on digital magnetic tapes. Subsequently, the data are subjected to extensive off-line analysis in both the time domain and spectral domain. The analysis includes phase conditioning, ensemble averaging, spectral transformations and matched filtering. the purpose of the analysis is (a) to reveal the nature of the various flow disturbance phenomena and; (b) to decompose flow disturbances into the different physical categories such as large-scale organized motion, coherent structures and incoherent turbulence. The decomposition of experimental data into these categories is valuable as it provides the necessary input information to computational schemes which try to predict flow behavior and performance of such combustors.

STABILITY MODIFICATION AND FLOWFIELD EVALUATION

OF A RAMJET COMBUSTOR MODEL

by

Larry A. Roe

ABSTRACT

The attainment of acceptably stable operating conditions in a research combustor is documented. This dump combustor, simulating many of the important physical processes occurring in operational ramjet engines, was operated at a pressure of one atmosphere and ambient inlet temperature. Initial operation was highly unstable. Modifications to the air supply system, fuel injection characteristics, and supply duct acoustics were successful in attaining stable combustion. The acquisition of velocity data proceeded, utilizing a laser Doppler anemometry system with titanium dioxide seeding. A change in the seeding material is indicated to increase the data rates.

OXIDATIVE THERMAL DEGRADATION STUDIES OF A SURROGATE JP-8 WITH A MODIFIED THERMAL PRECIPITATION APPARATUS

By William D. Schulz

ABSTRACT

A 12 component surrogate JP-8 fuel was developed and used in thermal oxidation studies with a modified thermal precipitation test apparatus. The apparatus features a fused quartz capillary tube for controlled feed of air or gas mixture. It is operated at atmospheric pressure and is inexpensive, convenient and completely inert. The surrogate JP-8, stressed in the test apparatus provides a means to study the effects of thermal stress on different classes of fuel component compounds simultaneously. The surrogate and method are particularly suited to comparative studies of antioxidant and other additive efficiencies.

MEASUREMENTS OF DROPLET VELOCITY AND SIZE

DISTRIBUTIONS IN SPRAYS

by

Richard S. Tankin

Abstract

A phase doppler instrument was used to measure droplet sizes and two components of velocity in a water spray. Vertical traverses and horizontal traverses were made across the spray near the sheet break-up region. More than 400,000 samples were taken in each traverse. The results show that the spray is axially symmetric, which is important for the planned theoretical analysis. The tangential velocity component is small - as expected.

AIRCRAFT ENGINE COMPRESSOR AND FAN REWORK PRACTICES

by

Robert A. Wheasler

ABSTRACT

An evaluation of Compressor and Fan blades and vane blending as practiced by the Air Force, Navy and some airline companies.

Overhaul Technical Manuals prescribing blade and vane rework limits and practices established by the Air Force, Navy and engine manufacture together with blade and vane engineering design specification drawings were evaluated, providing an incite into where losses may be expected to occur in compressor and fans during in-service use.

Examples of the losses to be anticipated in engine performance (specific fuel consumption, exhaust gas temperature) resulting from acceptable rework practices are presented.

ABSTRACTS
AVIONICS LABORATORY

THEORETICAL RESOLUTION OF MULTIPLE FREQUENCIES

by

David Choate

and Diana Major

ABSTRACT

An algorithm is developed to pair multiple
frequencies with their residues modulo IFM receiver bandwidths.
If these residues are distinct within each receiver and the
number of these receivers exceeds the number of frequencies, then
this pairing is perfect; that is to say, spurious frequencies can
never arise. These conditions are shown to be the best possible.
A suggestion is made on how to control noise.

LADAR Target Detection and Recognition

by
Dr. R. H. Cofer

ABSTRACT

LADAR has served as the focal point for this Summer Research
Program into performance improvement of model matching forms
of automatic target detection and recognition. The key
result obtained is a theoretically encompassing strategy of
probabilistic evidence accumulation based upon optimal use of
readily available 3-D target and sensing phenomenology
modeling. Utilities of the strategy lie in such areas as:
fusion of spatial data within and across sensors, indexing or
final evidence accumulation within the ongoing AF SAR Expert
System test bed development, detection and recognition at
extreme ranges where optimal performance is critical, and in
developing upper performance bounds for specific ATR problem
domains.

Significant results were also achieved at a more physical
level, as well. A detailed breakdown of the above theory in
terms suitable for the LADAR problem is given. A mini-SAR
Expert System computer environment has been developed on the
SUN work station in advance support of continuing Research
Initiation Program research and ultimate integration of code
into the AF SAR Expert System work bed. Quantities of LADAR
data has been rehosted to this new environment to improve
accessibility. Finally initial exploratory concepts have
been formulated to improve overall executability of the
concepts advanced.

Toolbox for Image Processing using Distributed Computing

Prof. Larry Crum and Graduate Student Michael Costarella

Abstract

Introduction

Present learning algorithms are highly computation intensive. Requirements for computer time severly limits practical application. Whereas computers can be expected to significantly improve in speed, speed increases alone cannot provide the orders of magnitude increases needed. Highly parallel computation will be necessary to render learning as a practical reality in systems. Transputers provide the most reasonable environment to study and develop new high speed alternatives.

The summer program provided an opportunity to be introduced to transputer networks and physical options for their usage, programming in OCCAM II and in higher level languages which have translators to OCCAM II, tools which are becoming available to develop and implement transputer algorithms, and some perspective on present applications of transputers. A variety of well-known image processing algorithms was viewed in terms of effective implementation on transputers. Initial work on a set of tools for Image processing was begun.

Focus

The focus of our research is to consider aspects of data distribution throughout various topologies of transputer networks. Hopefully methods suitable for use in the implementation of a collection of "parallel" image processing algorithms can be developed. These will be combined with a number of other software subsystems to create an adaptive vision system built on transputer technology.

Research commensed with familiarization with transputer architecure and programming environments. An appropriate data structure for image representation was investigated. The image processing algorithms complementation, convolution, filtering, and histogram measurement and modification were reviewed in terms of abilities to implement using the data structure.

ANALYTICAL MODEL OF A UNIQUE E-O BEAM SCANNER

by

Mohammad A. Karim

ABSTRACT

This report summarizes the research performed during the USAF-UES Summer Faculty Research Program. The work consisted of developing an analytical model for characterizing the beam-steering characteristics of a unique electro-optic (E-O) beam scanner. The beam scanner in question consists of a combination of an echelle grating and a nonlinear refracting material sandwiched in between two transparent electric plates. Two particular schemes for introducing electric field were explored. The current quantitative results along with those expected to be generated through a follow-up mini-grant study would be able to dictate the design characteristics of the most optimum nonlinear refracting material based optical beam scanning system.

DYNAMIC TASK SCHEDULING FOR THE "ADA DISTRIBUTED SYSTEM EVALUATION TESTBED (ADSET)"

BY

Dar-Biau Liu

ABSTRACT

The ADSET (Ada Distributed System Evaluation Testbed) has the capability to support an Advanced Multi-Purpose Support Environment (AMPSE). The AMPSE's simulation software will be written in Ada. It provides a real-time simulation support environment for testing and evaluation of Embedded Computer System (ECS) Operational Flight Programs (OFPs). The simulation software is hosted on multiple distributed processors connected with SMARTNet (Shared Memory Architecture Network). Two dynamic task scheduling algorithms on ADSET system are proposed.

Ada Compiler Efficiency Evaluation

by

James L. Noyes

ABSTRACT

Due to the complexity of the Ada Programming Language, it is not only important to validate the Ada compilers, but it is also necessary to compare their relative efficiencies. The ACEC (Ada Compiler Evaluation Capability) system was developed by the Boeing Military Airplanes Company for the Ada Joint Program Office (AJPO) to help determine these relative efficiencies. One of the key programs in this system is called Median, which may be used to evaluate the relative efficiency of Ada application code (compilation and execution) time and memory storage. Median is based upon a Median Polish technique for examining and summarizing tabular data. The rows of this table correspond to benchmark test problems and the columns correspond to Ada compiler systems to be evaluated. The table entries can be (1) execution times, (2) compilation times, or (3) memory used by each benchmark application program. Due to the importance of this evaluation process, the Median technique needs to be investigated. Because of the large number of benchmark programs available, a methodology is also needed to aid the ACEC user in choosing the appropriate benchmark programs to test the required Ada language features. Once this is done, Median can be better used to help in selecting an Ada compiler system.

212

Towards a Course-Grained Test Suite for VHDL Validation

by

Robert C. Shock

ABSTRACT

One of the paramount issues facing the electronic community is how it should respond to the various implementations (compilers) of the newly developed standardized language VHDL. The properties of uniformity and portability of source code must be ensured else chaos, duplication and soaring cost will follow. It is suggested that a course-grained approach of testing these compilers be enacted. This report also describes the development and implementation of a tool set that allows the programmer to control individually the letter style, the type style and the shape style of source code.

ABSTRACTS
FLIGHT DYNAMICS LABORATORY

PARAMETRIC STUDY OF COMBINED BOILING AND PARTIAL DRYOUT

IN LIQUID METAL HEAT PIPE WICKS

by

Larry W. Byrd

ABSTRACT

Boiling heat transfer in a wick with partial dryout was modeled. The vapor flowrate consists of molecules evaporated from the liquid/vapor interface plus those in bubbles formed at the base of the wick and convected to the interface. The evaporation rate was estimated as that due to conduction to the interface. The equivalent thermal conductivity was calculated from wick, liquid and vapor properties. Darcy's law was used to relate mass flowrate to pressure drop in both the two phase and vapor filled regions of the heat pipe. In the two phase region, a linear relation between the liquid saturation in the pores and the relative permeability was used.

The effect of the interface location depended on the core temperature. Above approximately 1000° K the heat flux varied as the inverse of the thickness of the wetted portion of the wick. At lower temperature the heat flux was greatly reduced due to the relatively large pressure drop in the vapor filled portion of the wick. Decreasing the liquid saturation down to approximately 10% caused an almost linear decrease in the heat flux. Below this saturation the heat flux began to increase in a non-linear fashion.

3-D Analysis of Laser Measurements of Vortex Bursting

on a Chined Forebody Fighter Configuration

by

Kenneth C. Cornelius

ABSTRACT

Future air combat will require aircraft maneuver performance that will exceed the capability of present day fighters. At high angle of attack in the post stall region, the aerodynamic control surfaces such as the vertical tail and rudder becomes engulfed in the separated flow field of the wing, and lose their ability to impart the yawing moment and side force required for active control of the vehicle. The key technology that is needed is the extension of aerodynamic control in the post stall regime of the flight envelope. The most promising approach for enhanced dynamic control of the aircraft is the use of properly placed blowing pneumatic jets in the nose of the forebody which eliminates the bistable nature of the asymmetrical development of the vortical separations. The main body of this report examines the physics of vortex breakdown to shed some light on possible blowing schemes that would have the greatest impact on this problem. From experimental 3-D velocimeter data of a vortex burst condition, a criteria for vortex breakdown has been formulated in terms of the local vortex flow variables which delineates between the onset of vortex burst and spiral instability. The Rosby parameter set which governs stability can be influenced by a jet which maximizes entrainment and imparts axial momentum to the outer helical streamlines.

ROBUST DESIGN USING INTERNAL MODEL CONTROL

by

Dennis W. Farrell

ABSTRACT

A two step controller design procedure is derived for MISO plants to achieve robust performance and robust stability. Internal model control (IMC) structure is used to control stable (includes poles at the origin), minimum phase (MP) and nonminimun phase (NMP) plants. The IMC structure, if used to control unstable plants (poles in open RHP), would be unstable, i.e., plant output increases without bound for a plant/model input disturbance. However, the derived IMC structure parametrization can be used directly to find a robust controller for a classic feedback structure that is stable. The unstable plants can be MP or NMP. Plant uncertainty in this paper is bounded by a disk shaped region, an approximation that encircles a complex mathematical described region with exact gain, phase, and parametric bounds. The disk shaped uncertainty bound is a compromise to have an analytic/numerical design procedure, for easier CAD implementation, at the expense of tighter performance and stability bounds that require graphical design procedures. The design procedures presented would apply to aircraft control and could be expanded to MIMO plants, two-degree-of-freedom controllers, and adaptive control.

Neural Networks and their Role in Visual Object Recognition

by

Augustus Morris, Jr., Ph.D.
and Nancy Faulkner

ABSTRACT

This work effort primarily explored the use of neural networks for object recognition. A compilation of institutions and companies doing work in this field was completed so that expert advice could be sought during the lab's development of neural network technology. Through the use of neural network development software, a preliminary network was designed to recognize simple geometrical shapes. Moments were used as features in the classification. Results were encouraging enough to pursue further development of this area.

A Study of Surface Roughness Effects in Hypersonic Flow

by

Arnold Polak

ABSTRACT

This report presents results from a theoretical study of surface roughness aerodynamic effects on hypersonic flow with strong viscous - inviscid interaction. Special interest is focused on the flow separation effects. The study centers around the numerical solution of the reduced Navier-Stokes equations. The algebraic eddy viscosity model is adopted for the turbulence closure and the roughness is represented by discrete arrays of uniformly distributed drag forces and heat source/sinks. The particular flow configuration studied is the hypersonic strong viscous - inviscid interaction induced by a compression ramp. The theoretical predictions are compared to the Flight Dynamics Laboratory Experimental data.

LIFE PREDICTION OF AIRCRAFT TRANSPARENCIES
BY ACCELERATED CRAZING TESTS

by

NISAR SHAIKH

ABSTRACT

Reducing the cost-of-ownership of aircraft transparencies made of various plastics is a principle concern of the Vehicle Subsystems Division and efforts are being made to increase the service life of these components. A durability validation plan is being developed which will enable prediction of the service life of a transparency design based on tests of the material at the fabrication stage.

Failure modes that necessitate the rejection of the transparencies include scratches, cracks, crazing, coating deterioration and delaminations. The validation scheme will be based on a chosen failure mode, namely acrylic crazing in F-16 canopies. Once a successful scheme has been devised, additional schemes will be devised for other failure modes of various aircraft transparency systems.

The plan is divided into three segments: 1. Accelerated laboratory crazing tests; 2. Generation and analysis of field data; 3. Correlation of laboratory and field data and derivation of a validation procedure.

STRAIN DISTRIBUTION IN COMPOSITE COUPONS IN TENSION

by

William E. Wolfe

Bryan Foos

ABSTRACT

An accurate measurement of tensile strength of graphite/epoxy composites can be difficult due to non-uniformities in the stress field, particularly in the area where the load is applied. The typical design of a tensile test coupon includes a fiberglass tab which is gripped by the loading machine and bonded to the composite specimen. A finite element study of the effect of tab geometry on the distribution of stresses and strains in tensile coupons was performed. The results of the analysis indicate that the strains in the specimen near the tab line are related to the angle the tab makes with the axis of the coupon and to the ply orientation. It was observed that the strain state in the coupon is less uniform when the tab line perpendicular to the long axis of the coupon than when the tab line is inclined.

CHARACTERISTICS OF AN OSMOTICALLY DRIVEN

THERMAL TRANSFER CYCLE

by

Juin S. Yu

ABSTRACT

A thermal transfer cycle utilizing membrane osmotic transport of water against a pressure rise is investigated from the viewpoint of the operation of a conventional absorption heat pump using an aqueous solution as the working fluid. Physical sorption, similar or equivalent to condensation, of water vapor in the membrane material is considered to be an essential step in the overall process of water transport. The thermal nature of this step during which the heat of sorption similar in amount to the heat of condensation for water vapor must evolve at the evaporator temperature or lower disqualifies the system in performance as a heat pump. Simple flow relations for the aqueous sugar solution are derived under simplifying assumptions. A set of numerical calculations is given as an illustration to show that the inferred steps are well within the limits of thermodynamics.

The Influence of Viscoelastically Damped Members on the Dynamic Response of Flexible Elastic Structures

by

Lawrence D. Zavodney

ABSTRACT

The effect of replacing lightly damped elastic members of a flexible truss structure with highly damped viscoelastic members is investigated. Both Kelvin and Maxwell one-dimensional viscoelastic models are considered. 1DOF and 2DOF system models are developed and used to compare the effects of using the two viscoelastic models. Analytic solutions are obtained for the governing equations and characteristic frequency-response functions are plotted. The results show that the one-dimensional Kelvin model is adequate to predict the complete suppression of some modes when damping levels are sufficiently high, but the one-dimensional Maxwell model cannot predict the modal suppression. Higher order viscoelastic models are required. A nonlinear analysis that includes quadratic and cubic nonlinearity in the elastic modulus reveals that classical nonlinear resonances do not appear in the highly damped viscoelastic members.

ABSTRACTS
MATERIALS LABORATORY

Prof. Karren Brito

No Abstract Submitted

The in-situ Laser Deposition of Superconducting Thin Film

by

Donald D.W. Chung

ABSTRACT

ArF excimer laser ablation of an $YBa_2Cu_3O_{7-x}$ pellet in 100 - 200 mTorr of O_2 ambient was used to deposit thin superconducting films onto $SrTiO_3$ and MgO substrates at 650 - 780 $^\circ$C. The as-deposited 0.6 - 1 μm thick films at 730 - 780 $^\circ$C substrate temperature were superconducting, without further high-temperature annealing. Cooled to ambient temperature in situ for 1.5 hours in flowing oxygen gas, the films showed complete diamagnetism and zero resistance up to 89 k with a critical current density of 5×10^5 A/cm^2 in zero magnetic field measured at 81 k. Low angle X-ray diffractive analysis showed that all the films were highly oriented with the C-axis perpendicular to their surface. Smooth surface morphology was observed in all films.

An Intelligent Neural Model for Recognition of

Input/Output Patterns for a Molecular Beam Epitaxy Process

by

Kenneth R. Currie

ABSTRACT

This paper discusses the problem of pattern recognition as applied to the rapid characterization of a Molecular Beam Epitaxy (MBE) process. The MBE process is a complex and difficult process to control, typically resulting in low production yields. The characterization of new materials may take months before the process can produce quality, repeatable results. This paper reviews the application of neural networks to recognize patterns within the input/output relationship of MBE process variables. The objective is the ability to self-improve process knowledge and thereby decrease the time necessary to find acceptable ranges for producing quality parts. Further research is suggested in order to incorporate the concepts of neural networks into a Qualitative Process Automation (QPA) philosophy that will make the MBE process both "self-directed" and "self-improving".

SCANNING TUNNELING MICROSCOPY AND

BALLISTIC-ELECTRON-EMISSION SPECTROSCOPY

by

Peter N. Henriksen

ABSTRACT

A scanning tunneling microscope from the Department of
Physics at The University of Akron has been configured to image
surfaces and Schottky-barrier heterostructures of electronic
devices fabricated in the Materials Laboratory of
Wright-Patterson AFB. Computer code has been written in
Microsoft C for: a) adjusting the tip-sample distance, b)
acquiring data for topographic images of surfaces, c) acquiring
ballistic-electron-emission spectra, and d) data processing for
image enhancement. Electronic circuits have been designed and
fabricated for: a) obtaining images of metal and semiconductor
surfaces at constant tunneling current, and b) measurement of
collector currents from the base metal electrode into the
semiconductor as a function of tip-to-base bias voltage. The
latter is a high-sensitivity (gain= 10^{11} V/A), low-impedance
current amplifier. Topographical images with atomic resolution
of highly oriented pyrolytic graphite have been obtained.

EVALUATION OF CR-SI ALLOYS FOR AEROSPACE STRUCTURAL APPLICATIONS

by

Joseph W. Newkirk

James Sago

ABSTRACT

Cr-Si alloys offer important advantages as an aerospace material, including high service temperature and good oxidation resistance. This in-situ composite combines a hard, brittle silicide phase with a softer chromium phase. The silicide phase has a high specific stiffness from room temperature up to 1400C. The soft phase is intended to add damage tolerance by bridging cracks and stopping them from propagating at low temperatures. Different volume percents of the two phases were evaluated and the bend strength measured as a function of temperature. Alloys with high volume percents of the silicide phase had good strength values at temperatures up to 1200C or more. Although toughness tests were not performed during this initial study, microhardness indents were used to demonstrate that the chromium phase could act as a crack bridging material. In addition the microstructural stability of these materials were studied with encouraging results. Finally, further study of these alloys is recommended and specific areas of study are included.

Molecular Modeling and Computational Chemistry:

Studies of Additives for Fluids and Lubricants

by

Harvey L. Paige

Molecular modeling and computational chemistry were used to study seven corrosion inhibitors and three anti-wear additives which have been found to be useful in chloro-trifluoroethylene (CTFE) fluids. These compounds were selected because of effectiveness and because their structures did not include proprietary moieties. The geometrical structures of all of the compounds were optimized using molecular mechanics and semi-empirical molecular orbital techniques. These structures were visually compared with the aid of a graphics program. The electronic structures of the molecules were calculated using a semi-empirical molecular orbital program and some of them were displayed as three dimensional maps and were also visually compared.

IMPROVEMENT IN THE DETECTION OF MICROCRACK INITIATION AND GROWTH

DURING FATIGUE CYCLING BY SURFACE ACOUSTIC WAVE SCATTERING

by

Michael T. Resch, Ph.D.

ABSTRACT

A surface acoustic wave non-destructive evaluation technique was used to detect the natural nucleation of surface microcracks in highly stressed regions of hourglass shaped 6061-T651 aluminum specimens during fatigue cycling. The experimental procedure involved excitation of a Rayleigh wave on the surface of each specimen and observation of the presence of a reflected echo from the nucleating crack superimposed on reflections from microstructural features surrounding the flaw. Contacting wedge transducers were used to excite the incident waves and to detect the reflected wave signals. The effectiveness of a split-spectrum processing algorithm to separate specular reflections of isolated cracks from non-specular reflections of microstructural features in the scattering field was demonstrated. Application of compressive stresses normal to the crack faces was observed to degrade the effectiveness of the processing algorithm to distinguish the presence of microcracks from the surrounding microstructural features.

INVESTIGATION OF THE THERMOMECHANICAL RESPONSE OF A TITANIUM ALUMINIDE METAL MATRIX COMPOSITE USING A VISCOPLASTIC CONSTITUTIVE THEORY

by

James A. Sherwood

Marcia J. Boyle

ABSTRACT

A research program has been initiated to investigate the stress distribution in a fiber-reinforced metal matrix composite resulting from thermomechanical loads. A detailed three-dimensional finite-element model of a unit cell of the composite was generated for evaluation via the ADINA finite-element code using the ADINA-IN preprocessor. Investigations of the thermomechanical response have been initiated using a classical temperature-dependent bilinear elastoplastic material model and a temperature-dependent viscoplastic unified state variable theory which includes drag stress and back stress state variables.

PHOTOREFLECTANCE OF AlGaAs/GaAs INTERFACES

by

Michael Sydor

ABSTRACT

A detailed examination of modulated photoreflectance spectrum from high electron mobility transistor materials, and other layered structures, reveals a distinct signal which can be attributed to the sharp AlGaAs/GaAs interfaces, essential in manufacture of high quality electronic devices. The characteristic photoreflectance appears as a broad signal originating from the laser illuminated GaAs/AlGaAs heterojunction. The signal occurs under the conditions when two-dimensional electron gas was detected or was expected to form in the potential well at the junction of the two materials.

Perceived time to contact as a function

of event structure during self motion

by

Ernest W. Hallford

Abstract

Recent self-motion studies have shown that viewers are
sensitive to visual information available in edge and flow
rates specifying forward speed and altitude, respectively,
although the two specifications may be partially confounded
for some viewers. These studies have improved our
understanding of visual factors affecting judgment and
control of self movements during events involving constant
speeds and level flights, as well as accelerations and
decelerations, and ascents and descents. The current project
extends these studies to questions regarding moving viewers'
judgment and control of their time to contact with designated
targets, as well as the prediction and control of contacts
involving moving objects at a distance from themselves.

The Effect of Luminance on the Perceived Saturation of Lights

by

Carl R. Ingling, Jr.

ABSTRACT

The effect of adaptation on the perceived saturation of lights has been studied extensively by Hunt (e.g., Hunt 1952; 1953). Hunt found that as adapting luminance decreases, the perceived saturation of lights decreases. At Hunt's lowest luminances, the chromaticities of dichoptically matched fields shrunk to the middle of the chromaticity chart; at high luminances, the chromaticities of the matches plotted near the spectral locus. These results run counter to similar work by Onley (Onley and Ingling, 1962), who found it necessary to add white light to a dimmer field for it to match the saturation of a dichoptically viewed standard. Although there are methodological differences between the studies, there appears to be no obvious explanation for the opposite results. The pilot work reported here verifies Onley's result.

ANALYSIS OF MICROSAINT AND COLORED PETRI NETS AS MODELING TECHNIQUES

by

Charles D. Kincaid

ABSTRACT

This paper describes and evaluates two modeling techniques: Task Network theory using MicroSaint, and Colored Petri Nets using Design/CPN. Both the concepts and the applications are analyzed to explore differences between the techniques. Enhancements are suggested for each technique that would expand its modeling capabilities. Finally, types of systems are described that would be most appropriate for each technique.

Thomas Lockwood

Degradation of the renal peritubular basement membrane in relation to toxic
nephropathy of fuels of military interest

Abstract

   Ultrastructural and biochemical aspects of damage to the kidney tubular

epithelium have been studied in relation to nephrotoxic fuels and hydraulic

fluids of military interest.   Both routine and novel aspects of the onset and

regeneration of tubular ultrastructural lesions have been correlated with

biochemical mechanisms of tubular damage; in particular the peritubular

basement membrane.   Much of the proposed investigation has been derived from

ongoing protocols underway at the Toxic Hazards Division of the Armstrong

Aerospace Medical Research Laboratory, Wright Patterson Air Force Base.   The

results are applicable to basic science and medicine as well as applied to

military toxicology.

Heart Rate and Other Cardiovascular Parameters as

Measures of Mental Effort

by

Lewis M. Lutton

Abstract

The recognition and measurement of fluctuating levels of
mental effort and fatigue in pilots is of great value to the
Air Force. The testing of cockpit efficiency, the training
of new pilots, the analysis of the multiple tasks required
of pilots or the monitoring of pilots on long range missions
all benefit from an awareness of the state of pilot
alertness and mental stress. Since it is not possible to
fully rely upon the pilot's subjective impressions of these
parameters some physiological measures of them are
desirable. This paper discusses the value of heart rate and
heart rate variability as such measures.

In general, heart rate and heart rate variability are
excellent qualitative measures of mental workload even
though problems like individual variation, differential
responses to different tasks and the roles of circadian and
ultradian rhythms need to be investigated. Furthermore,
these parameters need to be supplemented with other
physiological parameters as is the goal of the PAT system
used by the Ergonomics and Workload Branch of HEG at AAMRL.

Breakdown of Total Information Processing Time

into During-Display and Post-Display Components

for Serial and Spatially Distributed Visual Presentations

by

Ethel Matin

ABSTRACT

Information processing speed was compared in serial and
spatially distributed visual displays, using performance
measures that assess total information processing time and
also allow separation of the time for processing while a
display is visible from the further processing that occurs
after it is removed. For all subjects, a significantly
shorter total time was required with the serial display,
which eliminated the need for saccadic eye movements to
access the data. With both display types, all subjects were
able to exercise some control over the distribution of the
total processing time, allotting a relatively long during-
display time and a correspondingly short post-display time
under one set of instructions, and the converse under the
other set. A high negative correlation, accounting for 80%
of the response variance, was found between the two
processing components, as would be expected if there is a
tradeoff between them in accomplishing the total processing
task.

Prof. Randy Pollack

Abstract not publishable at this time

Kinematic Mappings Between the EXOS Handmaster Exoskeleton[1] and the Utah/MIT Dexterous Robot Hand

by

Michael M. Stanisic

ABSTRACT

Part of the overall Robotic Telepresence effort at the Harry G. Armstrong Aerospace Medical Research Lab (AAMRL) is controlling the fingers of the Utah/MIT Dexterous Robot Hand so that they will emulate a human's finger motions, providing a direct human-in-the-loop kinematic control of the robotic fingers. The focus of this effort was to develop the required kinematic mapping (the mathematical transformation), allowing the Dexterous Robot Hand the ability to grasp and position objects (such as tools) with its finger tips under the telepresence control of a human operator. The developed mapping of arbitrary human finger tip motion to robotic finger tip motion was successfully implemented.

[1] The EXOS Handmaster Exoskeleton was originally developed by Arthur D. Little Inc. and is now referred to commercially as the EXOS

Harness Belt Task

by

Joseph Szucs (Summer Faculty Research Fellow)

Vincent Dimiceli (Graduate Student Research Fellow)

ABSTRACT

A new version of the Harness Belt Option of the Articulated Total Body (ATB) model [3,8,9] has been constructed. This new model minimizes the total elastic potential energy of the harness system under the following constraints: (1) the component of the belt tension force that is perpendicular to the body surface is balanced by the deflection force exerted by the body due to deformation; (2) the friction force created by the belt tension force is not smaller in magnitude than the component of the belt tension force that is tangential to the body surface. It was found by us that the old version of the Harness Belt Option does not minimize any function, it only imposes constraints (1) and (2) with the difference that in (2) it stipulates that the friction force is not smaller in magnitude than those two components of the tension force that are tangent to the body surface and are parallel and perpendicular to the belt line. These constraints are physically wrong and do not determine the motion of the harnesses uniquely. This causes the failure of the old model.

We have started computer implementation by writing two new subroutines.

ARTICULATED TOTAL BODY (ATB) VIEW PROGRAM WITH HARNESS-BELT IMPLEMENTATION

BY

Chi-Ming Tang

ABSTRACT

The Articulated Total Body (ATB) model is currently being used by the AAMRL to study the human body biomechanics in various dynamic environments. The VIEW program provides a graphical representation of the simulation output from the ATB model. The original graphics output of the VIEW program was developed to suit the early ATB model version, that is, the graphics output of the human body is represented by the ellipsoids without the harness belt attached. The new version of the VIEW program has the capability to depict harness belts as well as the body segments.

INSIGHTS INTO HUMAN FACTORS IN AVIATION WITH EMPHASIS ON NON-CANONICAL FLOW FIELDS

by

Ebo Tei, Ph.D.

ABSTRACT

In accordance with the summer research goals and objectives that were arrived at, research effort during the 10-week period was concentrated in two areas: (a) developing a broader perspective of the various research activities pertaining to human factors in aviation that were of interest to the US Air Force; (b) designing a preliminary experiment to explore the perceptual factors that may operate during low-altitude flights in non-rigid environments. Both these objectives were achieved.

EFFECTS OF DATA ERROR ON PROBLEM-SOLVING HEURISTICS

by

Bonnie J. Walker, Ph.D.

and

David R. Harper

ABSTRACT

The effects of two levels of system failure on scientists' and pilots' problem-solving heuristics using the Wason 2-4-6 rule induction task were assessed. Results indicated that most subjects preferred to test their hypotheses by examining evidence which would confirm their ideas. Subjects given system failure conditions were less likely to solve the task and used significantly more tests and test replications. Furthermore, the heuristics used to solve the task in the current study were very similar to those used in earlier studies which had utilized undergraduate subject pools, demonstrating that advanced education and scientific experience does not necessarily change problem-solving styles.

246

ABSTRACTS
HUMAN RESOURCES LABORATORY

Software Development to Support Data Collection and

Analysis of Cognitive Task Analysis Studies

.by

Christopher Bell   Ron VanEtten

ABSTRACT

The Air Force Human Resources Laboratory (AFHRL) is engaged
in a series of projects to capture expert knowledge and
strategies to facilitate training of novices and to hasten
the acquisition of expert level skills. The summer project
has developed software to automate and simplify the capture
and analysis of Precursor / Action / Result /
Interpretation (PARI) data (both text and graphics) by the
AFHRL personnel. An existing standard software package
(dBASEIII+) has been modified, significant extensions made
to the available knowledge base concerning aspects of this
package and new software modules created and tested to
achieve this automation. A hypertext system was evaluated
to permit the analysis of data across problem domains. The
project has demonstrated the utility of dBASE III+ as a
file management system for complex file interactions in a
portable computer environment.
Work in applying expert system strategies for automating
the analysis stage and in the hypertext based extraction of
common themes will lead to further increases in the
productivity of AFHRL researchers.

Computer-based training for complex, dynamic tasks.

by

Kevin B. Bennett

ABSTRACT

For a variety of reasons the Air Force is interested in improving the efficiency
and effectiveness of programs for training personnel to perform complex, dynamic
tasks such as those found in the command and control environment. This report
describes a research and development (R&D) program that was initiated to
investigate issues in computer-based training for dynamic tasks. R&D completed
during the USAF SFRP includes the design, implementation, and initial analysis of
two experiments and the continued development of a part-task trainer. This
development includes the design of an integral display, an animated functional mimic,
an enhanced learning environment, and the incorporation of the part-task trainer into
a "windowing" environment. The report also briefly describes proposed R&D for the
AFOSR RIP.

Working Memory and Cognitive Structure

by

Kathryn F. Cochran
Alice Horton

Abstract

The research described in this report was designed in the context of the Learning Abilities Measurement Program conducted at AFHRL, Brooks AFB, Texas. The goal of this research was to investigate the influences of working memory and prior knowledge on the development of conceptual information stored as declarative knowledge in memory, and it is based on the theoretical conceptions of working memory developed by Baddeley and Anderson, and advances in the measurement of this construct made at AFHRL. A modification of Novak & Gowin's concept mapping procedure was developed for computer presentation, and was used as pretest and posttest measures of conceptual understanding in a test battery with five measures of working memory.

Due to unforeseen software incompatibility problems, the data analyses for this research are incomplete. The process of transferring floppy disk information to the mainframe computer at the University of Northern Colorado was more complex and time consuming than expected. This report was delayed as long as possible, but these problems could not be resolved before Oct. 1. A complete final report will be submitted as soon as possible.

Prof. Douglas Mandra

No Abstract Submitted

FISHEYE REPRESENTATION OF INFORMATION: IMIS USER INTERFACE

by

Deborah A. Mitta

ABSTRACT

A computer interface capable of presenting information in a usable format improves the quality of human-computer interaction. A user often experiences difficulties in accessing and interpreting information because his knowledge of both the underlying structure of the information and the relationships between a currently observed information element and other elements in the structure is limited. Another problem typically occurs during routine human-computer interaction: the amount of information to be presented exceeds the amount of space provided by the display medium. One technique recently developed as a means of enhancing the quality of human-computer interaction is known as the fisheye lens viewing strategy. This technique presents information concerning a point of interest (focus point) in great detail; less relevant information is presented as more of an abstraction. In this manner, the global aspects of the entire information data structure are not eliminated from the user's view.

This report demonstrates how fisheye views are used as a mechanism for filtering details associated with maintenance data. Results to be presented extend the original fisheye concept. The first extension allows the fisheye technique to be applied to information described by any general network, not only information represented by tree graphs. In a tree network, arcs connect nodes that are at most one level apart such that the link between any two nodes defines a parent-child relationship. By allowing information to have a general network structure, additional "family" relationships are available (e.g., sibling or grandparent links). The second extension illustrates that fisheye views resulting from multiple focus point selections are possible. In these views, detail associated with each focus point is presented, and the global context associated with each point is maintained.

<u>The Validation of Occupational Learning Difficulty(OLD) Index</u>

<u>as a Predictor of Retrainee Performance</u>

by

Miles E. Simpson

<u>ABSTRACT</u>

This study began a validation of the Occupational
Learning Difficulty Index was to be validated through
predicting of retrainees' time to upgrade and time to
promotion of retrainees. retrainees' former Air Force
Specialty's Occupational Learning Difficulty Index was
to predict their advancement rates. The data was from
the study of Air Force enlisted personnel who retrained
between 1972 and 1978. A demographic analysis of the AFSs
during this period revealed many major changes in the
opportunity structure. Some AFSs lost most of their
personnel; a few AFSs were relatively stable and a handful
experienced expansion. Also, some AFSs were top heavy;
others were bottom heavy. Validation of the OLD's Index
or measures of individual characteristics must take the
AFS's opportunity into consideration.

Assessment of Intelligent Tutoring Systems

by

William L. Smith

ABSTRACT

Intelligent tutoring system (ITSs) have a relatively short history, about one decade. It is not surprising, therefore, that the primary focus of research on ITSs has been on functionality and on short-term effectiveness in the tutoring context. Yet to be conducted is assessment research focussing on how ITSs affect "on the job" performance or on how using a sequence of ITSs affects performance on each subsequent ITSs. A continuum of research from pre-experimental and laboratory studies to job-effect studies is necessary in order to interpret the results of research at any point in the continuum. Such research was initiated using CONFER, a text-based ITS designed to help students better understand a text they have read. Because CONFER can be used in a university freshman composition course setting, both small-scale sampling (case studies and intensive analyses of rich data) and large-scale sampling (for generalization) can be done. The data collected includes think-aloud-protocols (done while using CONFER and while writing an essay) and interviews to provide rich data and comparative text-analyses of the transcript of the conference with CONFER and the written essay to provide evidence of direct effects.

THE ROLE OF THE INSTRUCTOR IN COMPUTER BASED TRAINING (CBT)

by

Stanley D. Stephenson

ABSTRACT

The question of what an instructor should do in CBT has not been answered. Although research on the role of the instructor in traditional instruction (TI) has produced a relatively high degree of consensus on what an effective TI instructor does, CBT research has not examined the instructor's influence on achievement. However, because of the differences between TI and CBT, the two learning environments may not be equivalent. The results of comparing the CBT environment with known, effective TI instructor behaviors suggests that in CBT effective TI instructor variables related to presenting the course material are allocated to the computer-based software, while effective TI instructor variables related to classroom management remain with the instructor. Compared to a TI instructor, a CBT instructor has fewer variables to use to influence academic achievement. A research program to study the CBT instructor's role with regard to academic achievement is recommended.

Evaluation of Air-Intercept Performance:

Observer Reliability Issues

by

Phillip D. Tomporowski

and

Royce Simpson

ABSTRACT

Four F-16 Instructor Pilots viewed videotaped Radar-Electro-Optical (REO) and Head-Up (HUD) displays of 16 air intercepts performed by student pilots. A 16-item rating form was employed to evaluate each intercept. A 5-point rating scale was used. Ratings were made of three types of intercepts: head-on, beam, and front quarter. Analyses were made of Instructor Pilots' ratings when the three intercept types were combined and when the intercept types were separated. Interrater agreement was greatest on global evaluations of performance; there was less agreement among the scores of raters on specific air-intercept maneuvers, particularly radar utilization. Improved observer reliability may be engendered through the use of rater-training sessions to familiarize them with the behaviors to be assessed and the evaluation criteria to be employed.

Career Progression in Air Force Enlisted Personnel:
An Examination of Two Alternate Criterion Measures

by

David J. Woehr

and

John A. Butemeyer

ABSTRACT

Two career progression measures for USAF enlisted personnel were examined as possible alternate criterion measures to training school final grades in ASVAB validation studies. One measure, Skill Level Acquisition Rate (SLAR), was found to have too little variance at lower levels and failed to show a substantial relationship with aptitude measures to serve as a viable criterion measure. The other measure, Grade Level Advancement Rate (GLAR), however was demonstrated to be a potentially valuable alternative criterion measure.

Development of the "City of Quality (Coq)" Group Decision Support System

by

Michael David Wolfe

ABSTRACT

A general theory for Group Decision Support Systems (GDSS) is here investigated. Mathematical models for multi-person multi-attribute decision making (MPMADM) are developed, and justification for use of a modification of the Taguchi cost function is presented for general use by non-profit organizational MPMADM problems. Total quality and unified life cycle engineering are just two examples of areas where this group information system may be applied.

The House of Quality paradigm is then examined as a framework for the "knowledge acquisition" of the parameters needed for the modified Taguchi loss function, and Hypertext is is shown to be an effective platform with which to produce a fully automated version of an integrated, linked series of houses of quality into a City of Quality (Coq) that serves as the basis of our GDSS.

New informatics for the production of hypertext systems were developed, including self-modifying hypertext documents. As a corollary to the development process, techniques for management and structured development of hypertext projects of were created.

258

VARIABLE RESOLUTION IMAGERY FOR FLIGHT SIMULATORS

by

Yehoshua Y. Zeevi

ABSTRACT

The design of the human visual system suggests a method for implementing sufficiently high resolution over a wide field-of-view in order to achieve the high fidelity required in flight simulators. Since conventional techniques of image processing are limited to position-invariant operations, we developed the appropriate formalism and techniques which can be applied in nonuniform filtering of images according to a distortion function which approximates the cortical magnification function. Variable resolution images were successfully generated on an IBM-PC, implementing the developed techniques. The images were subsequently transferred to a wide field-of-view display system for psychophysical experiments which will determine, in turn, the optimal distribution of displayed information according to a perceptual criterion. Such experiments have just begun and will continue in the follow-up program.

NEUROCOMPUTING THE STUDENT MODEL
IN AN INTELLIGENT TUTORING SYSTEM

by

Robert A. Zerwekh

ABSTRACT

Current intelligent tutoring systems (ITSs) share a common architecture, two components of which are the student module that contains information about the student using the tutoring system and an instructional module that consists of pedagogical strategies and plans. The pedagogical plans generated by the instructional module are designed to be individualized for the student who is using the ITS. The student module, therefore, must be constructed so that it models the current student's cognitive states and requirements.

This report critiques current student modeling techniques as computationally too demanding due to very large data bases that attempt to capture all possible errors a student may commit and/or all possible inferences that may be made during a tutoring session. An alternative approach to the student modeling problem is proposed that involves using neural network technology both to model the student and to analyze this model. Follow up research is proposed that will implement this approach in an intelligent tutor for foreign language teaching.

STATISTICAL ANALYSES OF DATA PERTAINING TO

GROUND WATER CONTAMINATION AND LABORATORY QUALITY CONTROL

by

Barbara Alvin

and

Lisa Newberg

ABSTRACT

Statistics were used to summarize and analyze data sets which
were collected in the Installation Restoration Program, a program
which is managed by the Air Force Occupational and Environmental Health
Laboratory. Different methods of summarizing ground water contamination
data were explored. The results of different ways of treating the data
were compared.

In addition to comparing methods of treating data on ground
water contamination, data from quality control samples were summarized.
This data had been collected to monitor the precision and accuracy of
the contracting labs which measure the concentrations of analytes of
interest. Methods for determining limits on the percent recovery of
an analyte and the standard deviation of that percent recovery were
explored.

DESIGN OF AN AUTOMATED RADIOFREQUENCY

RADIATION MEASUREMENT SYSTEM (ARRMS)

Stewart J. Maurer

ABSTRACT

In order to increase the measurement capability of the electromagnetic radiation consultant branch of the Air Force Occupational and Environmental Health Laboratory (AFOEHL), a design using a spectrum analyzer, power meters and a wide selection of antennas is proposed. The frequency coverage is from 50kHz to 22MHz and incorporates GPIB/IEEE 488 programmable equipment which will allow for a highly automated system. An antenna mount using a stepping motor is proposed which will give three axis data by means of rotation on a central axis. Prices and suppliers of the components are given.

CONSTRUCTION AND USE OF AN IDENTIFICATION MANUAL FOR IDENTIFYING FIBROUS MATERIAL BY SCANNING ELECTRON MICROSCOPY WITH ATTACHED X-RAY ANALYZER

by

Edmund C. Shearer

ABSTRACT

The air asbestos analysis laboratory at Brooks Air Force Base often needs to identify fibrous material that may or may not be asbestos. In order to help improve the laboratory's ability to identify such fibers, a pictorial manual using scanning electron microscopy was assembled. The manual includes 75 different fibrous and particulate samples which might be commonly found in air asbestos analyses. The manual consists of 250X and 2000X printed micrographs, a brief description of the sample, particle and fiber size measurements where appropriate, and qualitative and quantitative elemental analyses performed by x-ray energy dispersion spectrometry. Because of the closeness in elemental compositions of different samples seen by this laboratory, considerable work was done to document the reliability of the x-ray analysis unit which was attached to the scanning electron microscope.

BIOLOGICAL ANALYSIS OF THREE PONDS

AT PETERSON AFB, COLORADO SPRINGS, CO

by

Gregory Zagursky

William H. Jefferson III

ABSTRACT

A series of three man-made ponds on the golf course at
Peterson AFB, Colorado Springs, CO were analyzed to
determine their current ecological status and future
potential for recreational fishing. Biological analysis
consisted of collection, enumeration and identification of
organism from the water column and sediment from three
sampling sites at each pond. The ponds were evaluated on
the basis of species diversity and the types of species
present. Chemical analysis of water and sediments for
toxicants was also performed.

The results indicate that ponds 1 and 2 are in
excellent ecological condition and should be able to
maintain stocked game fish which are safe for human
consumption. Pond 3 cannot be recommended for stocking
with fish in its current condition. Low species diversity
and the presence of pollution indicator species suggests
that this pond is being stressed by an unknown pollutant.
The most like source is a storm drain which may be
chronic source of pollutants for this pond.

ABSTRACTS
SCHOOL OF AEROSPACE MEDICINE

Convergence Properties of the

Occurrence/Exposure Rate

by

Thomas Abraham

ABSTRACT

In this paper, we make an attempt to determine the degree
of convergence to the limiting properties of the [*]Occurrence/
Exposure Ratio by resorting to computer generated samples
in the context of a Poisson or exponential death process
that has a constant death rate.

[*] Refer to the rage on Objectives of the Research Effort.

267

Transmission Electron Microscopy of Mouse Macrophage RAW 264.7 Cells

treated with Lipopolysaccharide, 3-Amino Tyrosine, and RFR

by

Robert V. Blystone

ABSTRACT

The mouse macrophage cell line known as RAW 264.7 was examined by means of transmission electron microscopy. These cells were being used in a protocol that was designed to investigate the effects of RFR on the cells after treatment with lipopolysaccharide and 3-amino tyrosine. The initial fine structure examination revealed the presence of probable viral particles of C-type morphology. Previous reports ind   1 that although the cell line was established through transformation with Abelson murine leukemia virus, that viral shedding did not occur in this transformed mouse macrophage line. The original cell treatment protocol was separated into its parts and subsequent treated cells were examined in the TEM. Based on this initial TEM examination, lipopolysaccharide is suspected of inducing the expression of the Abelson murine leukemia virus by the RAW 264.7 cells. The virus was observed in all three morphological states: forming, budding, and shed. The possible induction of a C-type virus from the RAW 264.7 genome with an endotoxin has far reaching implications.

Effects of Microwave Radiation on Cultured Cells
Prof. Caudle-Alexander
ABSTRACT

The potential hazardous nature of radiofrequency radiation (RFR) has been of great concern for several years. This study was conducted to: (1) further elucidate the effects of low field intensity microwave radiation on cultured cells, (2) to determine if there would be elevated levels of the mRNA of certain oncogenes, and (3) understand more about the mechanisms of radiofrequency radiation on living cells and to characterize these interactions at a molecular level. DNA/RNA hybridizations were performed on cells which had been t᠆ ated with the mitogen lipopolysaccharide (LPS) alone, or in combination with the metabolic inhibitor 3-amino-L-tyrosine (3AT). Results from such experiments can contribute to or establish guidelines for medical, industrial or military personnel who may be exposed to radiation in the course of their ᴐccupation.

THE EFFECTS OF THREE REPUTED CARBOXYESTERASE INHIBITORS UPON RAT SERUM ESTERASE ACTIVITY USING PARANITROPHENYL AND NAPHTHYL ESTERS AS SUBSTRATES

by

James P. Chambers, Ph.D.

ABSTRACT

Using rat serum as source of esterase activity, a quick and efficient method of assay was developed using two paranitrophenyl esters taking advantage of the water solubility of the paranitrophenoxide anion. Esterase activity was terminated by addition of chloroform and released paranitrophenol converted to the 400 nm absorbing paranitrophenoxide anion by addition of 0.2 M phosphate buffer, pH 9.0. Paranitrophenoxide is quantitatively partitioned into the aqueous phase while leaving unhydrolyzed substrate in the organic (chloroform) phase. These conditions avoid nonenzymatic base catalyzed, hydrolysis of chloroform soluble, residual substrate. Using the above assay and Ecobichon's method for assessment of hydrolysis of naphthylacetate [12], the effects of three reputed carboxylesterase inhibitors (2-o-cresyl-4H-1:2:3-bensodioxaphosphorin-2-oxide, CBDP; bis-p-nitrophenyl-phosphate, BNPP and tetraisopropyl pyrophosphoramine, Iso-OMPA) were determined. Data presented here indicate the presence of an esterase activity in rat serum that when assayed with naphthylacetate is extremely sensitive to the inhibitor CBDP.

Anti-G Suit Inflation Influence on Lower Extremity

Muscle Performance during Sustained +G$_z$ Acceleration

by

Mark W. Cornwall

ABSTRACT

The purpose of this project was to investigate the influence
of the Anti-G suit on muscle performance during exposure to
sustained +G$_z$ acceleration force. The amplitude and
frequency of the myoelectric signals from the erector
spinae, abdominal, hamstring, quadricep and
gastrocnemius/soleus muscles were recorded from 3 subjects
during sustained gravitational stress of 6 +G$_z$. Each
subject was tested under two separate conditions: 1) with
the Anti-G suit and 2) without the Anti-G suit. Because of
the low sample size, the results are certainly not
conclusive. Within that limitation, they do seem to
indicate that 1) subjects contract their muscles less while
wearing the G-suit compared to when they are not wearing the
G-suit, 2) individuals with longer duration times at
sustained +G$_z$ are maintain a higher level of muscle activity
during the exposure compared to those with low duration
times and 3) only the abdominal muscle showed signs of
fatiguing as a result of the +G$_z$ stress.

PCR-Analysis and in situ Detection of Ureaplasma urealyticum and
Mycoplasma hominis

by

Paul Calvo and
Vito G. Del Vecchio

ABSTRACT

Three DNA probes which were specific for either U. urealyticum or M.
hominis were used as models for PCR analysis. The sequence and composition
of these target sequences are in the process of being determined in order to
profile their restriction endonuclease sites and to synthesize
oligonucleotide primers. These primers will define and limit in vitro
amplification of only target sequences.

In situ DNA hybridization using biotinylated probes and an FITC-streptavidin
signal was proven to be specific and offer the ultimate sensitivity for
elucidating the presence of these organisms in artificially infected tissue
cultures as well as clinical samples. The probe for Ureaplasma DNA was
specific; however, that for Mycoplasma displayed some cross reactivity with
Ureaplasma DNA. Investigation of stringency may render the Mycoplasma
probe more specific.

The Influence of Broad Spectrum Illumination on Circadian Neuroendocrine Responses and Performance

by

Patrick Roy Hannon

ABSTRACT

Plasma levels of the pineal hormone melatonin are greatest during the sleep phase of the vertebrate circadian cycle. Orally administered melatonin has been associated with sleepiness and increased measures of fatigue. Recently, melatonin levels have been shown to be acutely suppressed by bright, white light in mammals including man. If increased light intensity can be used to control levels of circulating melatonin, then it may phase shift the sleep stage of the circadian cycle and attenuate fatigue degraded performance. The objective of this research effort was to assess the effects produced by wide spectrum, bright illumination on plasma melatonin and to determine if this treatment can reduce fatigue and enhance performance during and/or immediately following stimulus presentation. This summer's research effort entailed exposing subjects to a dim light condition or one of two bright light treatments from 1800 hrs to 0800 hrs the following day. Bright light conditions consisted of one of two presentations: (a) overhead and (b) facing presentation. Data collection included behavioral, physiological, and blood chemistry measurements on 9 subjects in a repeated measures research format.

<u>The relationship between locus of control, performance on</u>
<u>cognitive tasks, and affective states after the consumption</u>
<u>of antihistamines in hi-and low-workload conditions</u>
<u>among aircrew personnel</u>

by

Cynthia Ford

<u>ABSTRACT</u>

Three hypotheses will be tested in this study. They are:
(1) There is a significant relationship between LOC and
cognitive performance. (2) There is a significant
relationship between LOC and affective states and (3)
Cognitive performance of internals will be superior to that
of externals across all conditions. Cognitive performance
of aircrew personnel in the three groups (benadryl, seldane
and placebo groups) will be assessed in high- and low-workload
conditions. The Rotter I-E Scale will be used to assess LOC
and will be administered at the commencement of the study.
The Performance Assessment Battery (PAB) which is a battery
of cognitive tests will be used to assess cognitive
performance. The Profiles of Mood States (POMS) will be used
to assess affective states. Each team of subjects will be
test~d o ie week at a time. To date, only one team has been
testeu Therefore, the attached is a progress report.

Aspects of the Diffusion of Inert Gases

in Biological Systems

by

Jeffrey F. Himm

ABSTRACT

Recent experimental work by Novotny et. al. (1989) on the uptake and elimination of radioactive xenon in dogs has revealed some interesting trends, as noted by Ingle (1989). First, the processes are not symmetric, with the elimination of xenon from the dog occurring at a different rate than the uptake of the gas. And second, both uptake and elimination can be modeled as hyperbolic functions of time. Various possible explanations are explored.

Studies of interactions between microwaves, melanin and melanocytes

by

Gwendolyn B. Howze

ABSTRACT

A synthetic form of the biopolyner melanin causes the reduction of cytochrome C. When oxidized cytochrome C and DOPA melanin were mixed, the absorption spectrum of cytochrome C changed to the profile characteristic of reduced cytochrome C. This reaction was studied in some detail. The reaction rate is concentration dependent. Microwave irradiation had no effect on the completed reduction reaction. Microwave (2450 MHz) irradiation seems to speed up the polymerization of L-β-3,4-dihydroxyphenylalanine (DOPA) to form melanin. Three types of evidence support this conclusion: increased absorption of irradiated melanin samples, decreased pH as compared with control samples, and a faster rate of reduction of cytochrome C as compared with controls. Preliminary studies of microwave effects on B16 melanocytes indicated no effect on growth.

TWO-PHASE REGRESSION MODEL WITH APPLICATION

by

Tze-San Lee

ABSTRACT

This research was motivated by a practical problem arising from the study of testing advanced anti-G valves to see if new manufactured valves meet the specific quality requiremert. Since the data collected from the test results of thirty-one anti-G valves possess some special f ˏ ˜es inclu˥ing repeated measurements and pˑssibly correl˳ted errors, none of the two-phase regression models currently available in the literature is readily applicable to the prolem at hand. Based upon the results of this research, it is recommended that statistical tolerance intervals for two-phase nested linear model with autocorrelated errors shall provide adequate criterion for testing whether new anti-G valves produced by the manufacturer indeed meet the required quality standard.

System and Signal Analysis of VEP Data
and Joystick Error Analysis

by

Harold Longbotham,
Lionel Ramos,
and Joe Rea

ABSTRACT

One of the missions of SAM/RZV is the analysis of deterioration of the combat readiness of Air Force pilots due to flash blinding and laser eye damage. At RZV research is being conducted into methods of measuring visual acuity of unresponsive subjects using the visual evoked potential. Research will be conducted on the ability of pilots to perform eye tracking with artificial scatomas that simulate laser eye damage. Simultaneously work is in progress in image processing to model the visual field so that perturbations to it, due to laser damage may be simulated. Our research in this area resulted in the suomission of two papers in image processing to the 1990 SPIE/SPSE conference, the submission of technical reports on analysis of joystick error and analysis of system error in VEP instrumentation, a literature search on robust methods (in statistics) that may prove applicable to VEP data analysis, and the outline of an expository paper on linear and nonlinear digital filtering and experimental design for data analysis with specific applications to VEP data.

Higher Plant Hormones Effect Upon
Chlamydomonas Phototaxis

by

Rex C. Moyer

ABSTRACT

The long term goal of this program is develop a way of testing drugs for their ability to improve night or long wave length vision of pilots and/or to shield their vision in certain wavelengths from laser or nuclear blast-induced flash-blindness. The specific goal of this summer's SFRP Fellowship was to determine if our recently developed phototaxis assay of Chlamydomonas reinhardtii CC-125 could be utilized to detect compounds which would stimulate phototaxis. The higher plant hormones Indole-3-acetic acid, Indole-3-butyric acid (auxins), Abscisic acid, Gibberellic acid, and the auxin-like weed killer, 2,4-Dichlorophenoxyacetic acid (2,4-D) were tested. This research showed that ethanol, in a final concentration of 0.28M does stimulate phototaxis. Indole-3-acetic acid and Indole-3-butyric acid stimulate phototaxis slightly more than ethanol alone. Thus it is not possible to determine at this point if they do stimulate phototaxis. Gibberellic acid, abscisic acid and 2,4-D, however, do significantly stimulate phototaxis over the ethanol controls.

It is safe to conclude that the phototaxis assay can rapidly and sensitively detect compounds which will stimulate phototaxis. This opens the possibility of testing drugs which may affect pilot vision. It also appears that this research may provide a rapid and sensitive bioassay for certain higher plant hormones as well as provide a new tool for the study of biochemical evolution in plants.

INFLUENCE OF RADIOFREQUENCY RADIATION ON PSYCHOTROPIC DRUG EFFECTS

Raymond Quock

ABSTRACT

The increasing use of microwave-emitting radar and communications equipment has generated great interest in possible bioeffects of radio-frequency radiation (RFR). Part of the research effort involves studying potential RFR-induced changes in psychotropic drug effects. The present investigation was conducted to ascertain the influences of various specific absorption rates (SARs) of RFR at two different frequencies upon behavioral effects of the benzodiazepine chlordiazepoxide. Male ICR mice were tested in a mouse staircase paradigm following RFR exposure (4, 12 or 36 W/kg SAR, 1800 or 4700 MHz) and/or pretreatment with chlordiazepoxide (8, 16 or 32 mg/kg). The findings indicate that certain levels of RFR are indeed capable of influencing effects of chlordiazepoxide, mainly reduction of sedative and/or anxiolytic effects of the drug. These data suggest that RFR exposure bioeffects include alteration of psychotropic drug effects.

POROUS GLASS AS BED MATERIAL IN A PRESSURE SWING ADSORPTION UNIT USED FOR AIR PURIFICATION

by

Paul O. Scheie

ABSTRACT

Removal of water vapor from air was attempted using granulated porous glass as bed material in a laboratory scale pressure swing adsorption unit. It eventually was possible to produce 1 liter/min of effluent with a dew point of -86° C, or 70ppb water vapor, from input air having a dew point up to $+15^{\circ}$C, 2000 ppm, or 50% RH. This performance compares favorably with that of molecular sieve beds.

MODELS FOR RFR BIOLOGICAL EFFECTS

by

Ronald L. Seaman

ABSTRACT

Efforts involved three activities related to action of radiofrequency radiation (RFR) pulses on biological systems. First, development of a nonmammalian model for RFR sensory effects was initiated. Electrophysiological techniques were adapted for use on a frog preparation exposed to RFR. Second, preliminary observations of RFR effects on biological free radicals were made. A special imaging system was used to view light created by a compound developed at SAM for detecting free radicals. Third, consultation was provided to a new Air Force contractor. Plans for RFR exposure schemes and biological preparations were discussed with faculty of the University of Texas - San Antonio.

AN INVESTIGATION OF DIOXIN HALF-LIFE HETEROGENEITY
IN HUMANS BASED ON TWO MEASUREMENTS PER SUBJECT

by

Ram C. Tripathi

Division of Mathematics, Computer Science, and Statistics

The University of Texas at San Antonio

30 August, 1989

Abstract

In this research, heterogeneity of the half-life of 2,3,7,8 tetrachlorodibenzo-p-dioxin (TCDD) in humans is investigated with respect to weight changes. This investigation is based on mixed-effects linear models with two repeated measurements per subject. The model can accommodate any number of covariates. By including relevant covariates and interaction terms in the model, this approach produces adjusted estimate of half-life of TCDD, and through the interaction term, an assessment of half-life heterogeneity in Ranch Hand Vietnam veterans. Some recommendations are made to further refine this estimate.

283

"Temperature Effects on Erythrocyte Sedimentation Rates in Whole Blood and on
Erythrocyte and Platelet Volumes"

by

W. Drost-Hansen
and John Lafferty

ABSTRACT

Erythrocyte sedimentation rates in whole, anticoagulated blood have been
measured over a wide temperature range (26°C to 53°C) at closely spaced intervals
(0.7°C or 0.9°C). Anomalous sedimentation rates are frequently observed near 30°-
32°C, and at 45° (±1°)C the sedimentation rate decreases abruptly and dramatically
in all sample studies (human, baboon, pig, dog, goat). The temperatures of the two
anomalies coincide with the temperatures at which vicinal (i.e., interfacially modified)
water is known to undergo structural transitions. In blood from humans, baboon and
pig the mean cell volume (MCV) goes through a maximum around 42°-43°C,
followed by a minimum near 45°C and a dramatic, large and narrow peak around
49°-50°C. Mean platelet volumes (MPV) for humans, baboons, and pigs generally
go through a broad minimum around body temperature (37°-38°C) followed by a
peak around 46°C. The values for MCV and MPV (and the temperatures at which the
maximum and minimum occur) are not affected by the transmembrane enzyme
blockers Digoxin or Verapamil. (A small effect on initial sedimentation rates is
observed with Verapamil. After 2 or more hours of incubation, this effect disappears.)
The heat-induced changes in MCV and MPV show notable hysteresis: the values of
these parameters remain unchanged after subsquent incubation at 24°C for at least 2
hours. Sedimentation rate measurements have also been made at 25°C and 37°C
on blood from 40 healthy, normal individuals and 30 patients with known pathologies.
On the basis of the preliminary data analysis it has not yet been possible to determine
if the temperature coefficient of the sedimentation rate based on these data may
contain diagnostically useful information not revealed by the standard, room-
temperature ESR.